Added Value through Design for Healthcare Facilities/Buildings in Saudi Arabia Within the Legislative Regulations of Saudi Arabia

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ABSTRACT

High-quality physical environments can promote health and well-being. A healthcare facility with an environment that is user centered, welcoming, and accessible, while also supporting staff and patient privacy and security has been found to enhance medical outcomes, and patient and staff comfort and well-being, which in turn have a positive effect on medical outcomes. The use of Evidence Based Designhas been shown to be of benefit to add value through design to a building .

A comprehensive review of relevant literature was used to develop an understanding of the factors perceived to add value to a healthcare facility. Data were derived from two instruments an expert survey and a group AHP pairwise comparison survey. The findings of the first instrument resulted in validation of the factors, both directly and indirectly related to design, proposed in the literature and added insight into some culturally specific perceptions of factors which add value to a healthcare facility. The second instrument was a pairwise comparison of the six main design criteria and 25 related sub-factors to gain a multi-user perspective of their priority in adding value.

The results from the first expert survey of the factors found in the literature and the AHP pairwise comparison survey were synthesized to develop a proposed framework to add value to healthcare facilities through building design . The framework was developed with consideration of factors indirectly impacted by design in addition to the design factors themselves. The proposed framework has six main criteria of Risk and Safety, Accessibility and Way-finding, Functionality, Cultural factors , Aesthetics, Comfort and Well-being and Cost with 25 sub-factors directly related to design of varied priority ranking found to add value to a healthcare facility within the Saudi Cultural context and presented in order of priority weighting . These were then related to their impact on the factors which add value to a healthcare facility which have been shown to be indirectly related to the healthcare facility design.

Findings suggest that while perceptions of factors that add value are mostly in agreement with those found in other studies, that there are some culturally specific factors that need to be considered in order to design facilities that provide the greatest value, including patient rooms of a size and design that allow for a caretaker to be present and to accommodate for a large number of visitors, In addition, there is a need to consider the direction for the prayer and the need for signage to indicate it in the room layout. They also suggest that added value through design can have a positive effect on medical outcomes and the satisfaction and well-being of staff and patients.

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I am making this project not only for marks but to also increase my knowledge.

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Healthcare and Healthcare Building Design Terminology: Definitions

Value: a positive impact on patient satisfaction, health outcomes and/or clinical results, improved visitor/patient caretaker experience, reduction in resource waste (including cost and time), improved function and well-being of the healthcare facility workforce staff and/or increased sustainability

Added value: An increase in value resulting from the increase in or addition of one or more factors

Evidence Based Design (EBD): Basing design decisions on research findings

Patient-centered care: the provision of 'care that is respectful of, and responsive to, individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions' (Institute of Medicine, pg. 40, 2001).

Analytical Hierarchy Process (AHP): A method developed by Thomas L. Saaty utilizing math and psychology to organize and analyze complex decisions.

Value management (VM): Designing a project to gain maximum value from resources and accomplish the project's objectives (Phillips, Martin, Dainty, & Price, 2008).

Healthcare and Healthcare Building Design Terminology: Acronyms

Ministry of Health (MOH)

Evidence Based Design (EBD)

Environment–Occupant–Health Framework (EOH)

Multiple Criteria Decision Making (MCDC)

Analytical Hierarchy Process (AHP)

Consistency Ratio (CR)

CHAPTER I

INTRODUCTION TO RESEARCH

1.1 Introduction

In this chapter the background of added value through healthcare facility design is given, along with a introduction to healthcare facilities in Saudi Arabia. The chapter concludes with an outline of the research in which research problem is stated, and an outline of the research aims and objectives, methodology, samples, and stages is presented.

1. 2 Background

The design of healthcare facilities is considered an integral aspect of quality healthcare (Sadler et al., 2011). Studies suggest that a quality healthcare environment should be centered on the users, welcoming, and easily accessible and navigated, while also supporting users' privacy and security (Volker, Lauche, Heintz, & de Jonge, 2008).

Healthcare facility design can have an impact on the well-being of all the users of the facilities. When the design of a healthcare facility is poor, the outcome for patients can be anxiety, elevated blood pressure, and increased need for drugs to relieve pain (Ulrich, 1991). Staff performance and retention can also be positively or negatively affected by healthcare facility design (Rechel, Buchan, and McKee, 2009).

Identifying the factors that add in healthcare has been the subject of a number of studies. These factors cover aspects both directly and indirectly related to healthcare facility design.

1.3 Value in Building Design

Building design has most often focused on functional efficiency of the space, and this focus has frequently produced facilities designed based on physiological factors and resulted in facilities that fail if they are stressful or unsuited to the psychological needs of users (Ulrich, 1991). Hicks, McGovern, Prior and Smith (2015) suggest that healthcare facility design is a complex process related not only to the allocation and design of physical spaces, but also the flow of patients, staff, visitors, equipment, and information.

Although there have been numerous studies with findings that have convinced architects and hospital boards of the role of healthcare facility design in adding value to healthcare organizations, designers often lack accessible information that provides insight into the specific factors in the healthcare facilities value chain that are beneficial in adding value (McGinley & Dong, 2011; Castro, Mateus, & Bragança, 2012). This information must be obtained through exploration of the various users' perspectives, in order to allow designers to develop an understanding of their needs and priorities (McGinley & Dong, 2011; Zhao & Mourshed, 2017). In a healthcare building there are many diverse users, including the patient, the patient's family, hospital employees, physicians, and payers, each of which may have a different perspective on the factors that add value, and this can impede the ability of the building designer to design a building with universal added value from all users' perspectives (McGinley & Dong, 2011). However, despite the

importance of public participation in the design process for health-care environments and services from the beginning where it can have the greatest impact, such participation often only takes place at the end of the design process (Payne, et al. 2015).

The user perspective of the facility can be influenced by many factors, including user purpose, gender (Parsons, 2002; Karjalainen, 2007; Zhao & Mourshed, 2017), age (Zhao & Mourshed, 2017), culture (Anåker, et al. 2016), state of health (Weiland et al., 2015), and acclimatization. In addition, the building design will reflect the contemporary dominant sociocultural, economic, professional, and aesthetic priorities (Bromley, 2012). This is of interest in light of the findings of Alvaro, et al, 2015 that 'patients and staff with favorable impressions of the building design fared better on most well-being-related outcomes relative to those with less favorable impressions'.

Zeliotis (2017), propose that healthcare building design for a specific specialty, such as a cancer care facility, requires consideration of the unique and specific needs of the professionals and other people who inhabit the building. There is a lack of research replicating the research done on optimal design of healthcare buildings in general , on cancer-related facilities to clarify similarities and dissimilarities (Gharaveis, Kazem-Zadeh M, 2018) or on the extent to which health benefits or outcomes are the result of the built environment (Zhang, Tzortzopoulos & Kagioglou (2019).

1.3.1 Introduction to Saudi Arabian Healthcare Facilities

The Kingdom of Saudi Arabia is the largest country in the Middle East with a land area of 2 250 000 square kilometers, consisting of mostly desert. The Saudi economy is currently in the process of differentiating the economy from a dependency on oil.

Healthcare in Saudi Arabia is provided free of charge to all Saudi citizens and also to expatriates working in the public sector. Private sector employers are required to provide paid healthcare coverage for expatriates, and some private sector companies provide healthcare coverage for Saudi national employees as well.

A unique feature of the Saudi healthcare system is the annual influx of pilgrims and other visitors to Makkah for whom the government provides free health services through Ministry of Health (MOH) facilities.

The Ministry of Health is responsible for public healthcare services in Saudi Arabia (Ministry of Health, 2009). Other organizations providing healthcare services include the private sector, non-governmental voluntary organizations and a number of semi-independent bodies. The health system is based on a mixed private, public, and other governmental sector model. The MOH has a wide scope of authority, including the regulation of health products and quality of services, and price setting for health services and pharmaceutical drugs. However, university teaching hospitals and the military hospitals are not under the authority of the MOH, and the MOH has only indirect control over private healthcare facilities, which are perceived to have greater service quality, ease of access, and more state of the art technology.

In 2017, there were a total of 487 hospitals with an overall capacity of 72,981 beds which corresponds to 2.2 beds per 1000 of the population (Ministry of Health: Annual

statistical book; 2017). These figures are projected to increase significantly as there were 35 new hospitals and two large scale medical cities being constructed as of late 2019. However, according to a 2018 report by UK-based property consultancy Frank Knight the country projected population growth and increasing numbers of ageing citizens will necessitate an additional 20,000 beds by 2025 and 40,000 by 2035 (Knight, 2018).

The strategic objectives of the Saudi National Transformation Program (NTP) 2020, adopted in 2016, which have both direct and indirect impact on the design of healthcare facilities are as follows: (1) to increase private sector share of spending through alternative financing methods and service provision; (2) to increase the efficient utilisation of available resources; (3) to improve the efficiency and effectiveness of the healthcare sector through the use of information technology and digital transformation; (6) to improve the infrastructure, facility management and safety standards in healthcare facilities; (7) to attain acceptable waiting times across all stages of service delivery; (8) and to improve governance in the health system in order to enhance accountability with regard to quality issues and patient safety (Saudi Arabia's Vision 2030. National transformation program 2020, (2106)

Healthcare facilities in Saudi Arabia vary widely in infrastructure, facilities and design. There is a lack of literature exploring the question of optimal healthcare building design from a multi-user perspective within the Saudi perspective, despite the fact that the country's Vision 2030 economic transformation strategy encompasses the commissioning of hospital services and building of medical facilities and medical cities,

the improvement of healthcare governance, and enhancement of communication and delivery systems (Vision 2030 Health Sector Transformation Strategy).

The need for a substantial increase in the number and capacity of healthcare facilities in Saudi Arabia presents an opportunity to incorporate Evidence Based Design factors that are found to add value to healthcare building design into the design/redesign of the facilities. Culture impacts user perceptions of design features in a healthcare building (Anåker, et al. 2016), There are some design factors specific to the Saudi culture which have been found to add value within the Saudi context; these include design features that accommodate for individual privacy needs in a culturally appropriate way (Ahmad, Singh, Kamal, and Shaikh, 2020), While some studies have identified factors that add value to healthcare buildings in general, there is a need to gain insight into which factors add the most value within the Saudi culture and context. Thus, an examination of the priority or weights given to the criteria and alternatives utilizing the AHP method and based on the judgments of experts in the specific context of Saudi healthcare buildings could bring to light some unique findings.

1.4 Statement of the Research Problem

While the use of Evidence Based Design for the development of frameworks, best practices, etc. has been well established within the realm of healthcare facility design; little research has been conducted within the culturally specific context of Saudi Arabia. However, studies have shown that culture has an impact on the user perceptions of the value of design factors in healthcare facilities (Brom ley, 2012; Health Building Note 00-01). Therefore this research seeks to gain valuable insight into the application of Evidence Based Design for healthcare facilities in the unique culture Saudi Arabia.

1.5 Research Aim and Objectives

The aim of this research is to determine the weighted comparison of factors that have been determined to add value to the healthcare built environment within the context of the Saudi culture in order to provide healthcare building designers with a framework as a design tool that provides designers with the knowledge of the design features that add the greatest value from a multi-user perspective.

1.6 Research Methodology in Brief

The secondary data was collected through a review of numerous relevant publications and studies in order to determine design related factors that had been found to affect hospital building value.

Primary data was collected through two survey instruments: the first survey instrument consisted of a series of both open and closed ended questions that required participants to give their expert opinion on whether or not factors derived from the literature review added value to healthcare building design in Saudi Arabia. The second survey was an Analytical Hierarchy Process (AHP) instrument consisting of fifteen pairwise comparisons of main factors and forty-five pairwise comparisons of sub-factors requiring weighted responses on the factors validated by the expert review.

The data from the expert review questionnaire survey was analysed using both statistical and thematic analysis.

The data from the AHP was analysed and used to determine the compared weights of design factors related to healthcare facility design within the Saudi context.

The results of the study were used to develop a framework that is proposed to guide evidence based healthcare design in Saudi Arabia in the future.

1.7 Sample

For the first survey instrument an expert sample was chosen based on specific criteria (being a professional with at least 2 years work experience in a healthcare facility in Saudi Arabia) that confirmed their expert status. The two year period was decided based on the length of a normal contract for expatriate workers who are a large part of the professional healthcare worker workforce in the Kingdom, thus ensuring that respondents had completed at least one contractual period. It was distributed by email to 15 individuals who had previously been approached to affirm their suitability and willingness to participate.

For the second survey instrument, the AHP weighted criteria survey, probability simple random sampling was used to gain a multi-user perspective with the criteria for inclusion being having entered a healthcare building in Saudi Arabia in some capacity. Potential participants were first contacted via phone or WhatsApp to explain the purpose and scope of the survey and request their willingness to participate. Upon receiving affirmation of this, the survey was distributed via WhatsApp and email to 20 participants pre-chosen based on their expert status or personal experience as an end user at a healthcare facility in Saudi Arabia.

1.8 Research Stages

This research is based on the concept of Evidence Based Design (EBD).

EBD research begins with a practice question and then goes through the following steps: (1) a systematic literature review; (2) a review of experiential evidence from clinical and design experts and best practice models; (3) an evaluation of existing research to determine applicability to the specific research; (4) integration of findings (evidence and experience) (5) an evaluation of the findings; and (6) the dissemination of findings (Melnyk & Fineout-Overholt, 2005).

The research was undertaken in a series of five stages; the stages were (see figure 1):

Stage 1: Comprehensive review of relevant literature and subsequent development of a list of factors shown to add value to healthcare facilities;

Stage 2: Development and implementation of an expert sample survey and analysis to validate the factors determined in Stage 1 within the Saudi context;

Stage 3: Development (based on the findings of Stage 2)and implementation of an Analytical Hierarchy Process Survey and analysis to determine comparison weights of the factors;

Stage 4: Integrated analysis of results from Stages 2 and 3;

Stage 5: Develop a framework for the factors that add the most value to healthcare building design within the Saudi context.

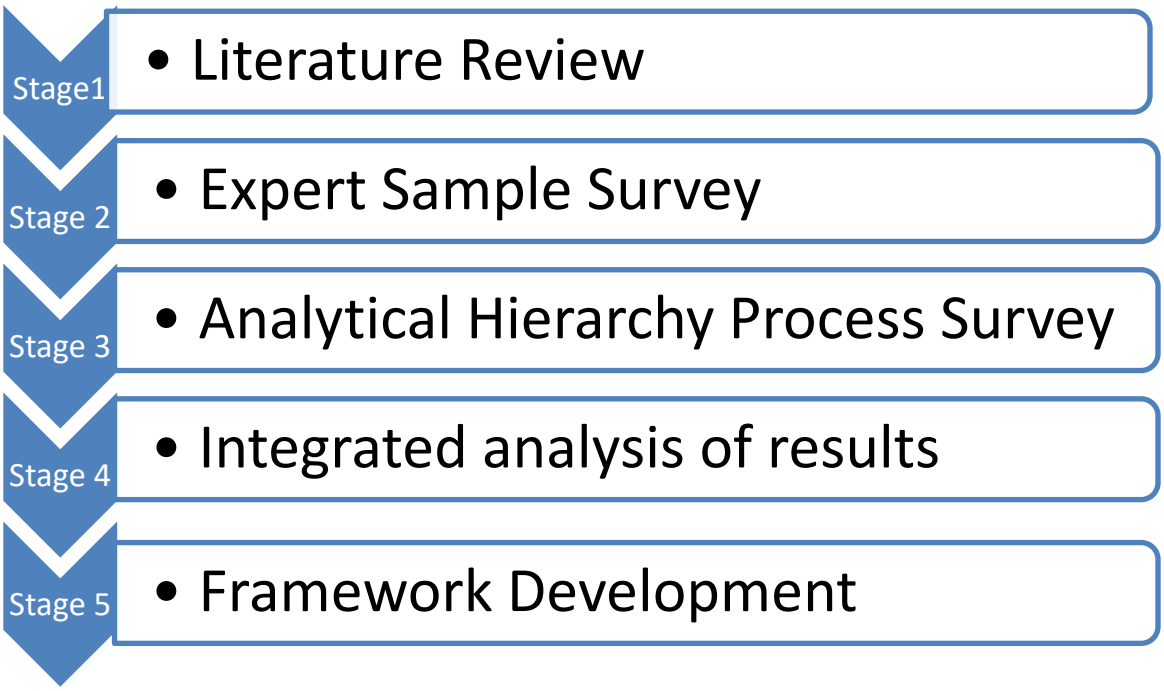


Figure 1 Thesis Steps

1.9 Thesis Structure

This thesis is structured as follows:

This thesis has been structured into a total of seven chapters.

Chapter 1: Introduces the topic and discusses the research problem, aim and objectives.

Chapter 2: Reviews relevant literature to identify factors that have been proposed to add value to healthcare building design.

Chapter 3 Highlights the research and analysis methods used in the study and the rationale behind the choice of a sequential exploratory mixed method research which includes a structured and semi-structured expert sample survey of 14 health care professionals with at least two years' experience working in a Saudi healthcare facility, and an Analytical Hierarchy Process based survey of 20 individuals who have experience of healthcare facilities in Saudi Arabia to gain a multi-user perspective.

Chapter 4: Presents the data and analysis of the Expert Sample which is then used to develop the AHP instrument.

Chapter 5: Presents the data and analysis of the AHP instrument.

Chapter 6: Presents the integrated findings from the two surveys and a discussion of the results.

Chapter 7: presents the framework developed for the design of healthcare facilities in Saudi Arabia, and finally,

Chapter 8: presents the conclusions and recommendations for future work.

1.10 Chapter Summary

In this chapter a background to the topic of the study has been given, followed by the research problem, the methodology and stages of the research.

In the following chapter the insight gained from a review of relevant literature will be presented.

CHAPTER II

A LITERATURE REVIEW OF VALUE ADDED BY DESIGN OF HEALTHCARE BUILDINGS

2.1 Introduction to Chapter

This chapter discusses the importance of EBD in the design of healthcare facilities. It begins by discussing the concept of adding value to a building and goes on to discuss the concept of Evidence Based Design. Later it outlines specific factors that research has found to add value to healthcare building design.

2.2 Evidence Based Design

The Environmental theory proposed in the second half of the nineteenth century by Florence Nightingale first suggested that design elements can affect patient health outcomes (Medeiros, Enders, & Lira, 2015). This led to an interest in specific factors that can affect the value of a building, and subsequently to the development of Evidence Based Design (EBD). One application of this has been to use EBD to design healthcare facilities based on research and practice that can promote patient-centered care and staff safety and satisfaction (Zimring & Ulrich, 2004), improve patient outcomes (Zengul & O'Connor, 2013) and which takes into consideration the user experience (Elf, Fröst, Lindahl, & Wijk, 2015).

The modern movement towards EBD in healthcare building design stems from a study conducted by Ulrich in 1984 in which he compared the effect of views of natural scenery

on surgical patient recovery to the recovery of surgical patients with views of a brick wall and found that the patients with the natural scenery views had shorter hospital stays, very given more positive evaluations by nursing staff, took less medication and had slightly fewer post-operative complications (Ulrich, R. S. , 1984; Huisman, Morales, van Hoof, & Kort. 2012).

EBD is proposed as a tool for designing healthcare facilities that are both cost-effective and function well for patients and staff (Becker & Parsons, 2007). It is based on the assumption that the built environment can have a positive or negative physical and psychological effect on those using it (Roughan ,2011; Capolongo , et.al, 2011) and while it can be applied to any built environment, it is of particular benefit when applied to healthcare facilities (Alfonsi, Capolongo, & Buffoli, 2014). EBD is seen as a way to design healthcare facilities that provide improved function for patients and staff and are more cost-effective.

EBD does not provide standardized tested examples; it is a “continuous process” producing “ad hoc” solutions for a particular hospital (Alfonsi, Capolongo, & Buffoli, 2014). The goal of EBD for healthcare buildings is to design and create spaces that serve to improve patient health outcomes and clinical results, reduce resource waste, facilitate the function of staff and promote sustainability, thus creating positive impact (Stichler & Hamilton, 2008; Ulrich, Berry, Quan, & Parish, 2010). The World Health Organization proposes that ‘*Environments are considered therapeutic (with healing qualities) when*

there is direct evidence that a design intervention contributes to improved patient outcomes" (Chapter 12 of 'Investing in hospitals of the future', WHO, 2009 Pg. 233). Anderson and Hamilton (2013) suggest that there is a need to focus on staff requirements in the hospital building design process that is often not effectively integrated into the design due to a lack of understanding of clinicians' routines and working practices on the part of those involved.

2.3 Patient Centered Focus

The IOM (Institute of Medicine) defines patient-centered care as: "Providing care that is respectful of, and responsive to, individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions" (pg. 40, 2001).

Collden, et. al. (2017) propose patient centered care as a factor in their three-factor healthcare facility value adding taxonomy. Studies have found that the built environment contributes to patient healing (Van der Voordt, 2015), and that that the indoor environment of a healthcare facility can impact patients' physical, physiological and psychological health outcomes (Codinhoto, et al., 2009); therefore, the focus on patient centered care relates to the design of facilities, given that patients have differing preferences, needs and values based on individual and cultural factors, and that the building design will affect the value chain of the facility. Several studies have shown that the customer's perceived value of the services provided depends on other factors in addition to quality of healthcare and costs. 'The building contributes to the healing of

patients, and as such, contributes to a better positioning of the hospital in the healthcare market' (Van der Voordt, 2015). This suggests that the design of a healthcare building can affect both patient medical outcomes and brand positioning for the healthcare facility.

2.7 Value and Added Value in the Built Environment Context

To understand how value can be added to healthcare building design, a conceptual definition of 'value' must first be given. Value is something that can be measured in terms of effort, exchange or currency and these measurements can be used in comparative evaluation that results in a decision and or desire to 'retain or obtain an ideal, item or service' (Annappa & Panditrao, 2012).

Perera and Ashworth (2015), propose that human actions are driven by requirements and needs and motivated by value. The relationship between value and function and between t value and cost can be expressed as:

Value = Function/Cost

Where function refers to the actions or activities for which an object is used or suitable to be used for and cost refers to the price that is paid for the object.

Another way to measure value is by looking at the relationship between value and function and function and resources. This can be expressed as:

Value = Function/Resources

Where function refers to the measure of how well the object achieves it required performance and where resources are measured in terms of the labour, materials, time or price required to accomplish the function (SAVE, 2015).

The traditional means to determine value for medical facilities has been to measure how efficiently they deliver quality healthcare in the most cost-efficient way; therefore value for a healthcare facility was defined by Porter in 2010 ‘as the health outcomes achieved per dollar spent ’. However, in 2016, Porter noted a slow shift in focus from cost efficiency to the value created for stakeholders and the impact on patient outcomes. Rechel, Buchan, and McKee (2009) found that:

> *“The ability of nurses to care for patients is influenced, inter alia, by the geographic dispersion of patients, the size and layout of individual patient’s rooms, and technology (such as pagers or computers). Also, increased use of information and communication technologies will continue to have increasingly important implications for healthcare workers.”*

Adding value to an organization is considered to have a positive impact on that organization’s sustainability. The concepts of ‘adding value’, ‘added value’, and ‘value-added’ are multidimensional constructs that can be interpreted in diverse ways (Jensen et al., 2012).

Value Management (VM) is used to ensure that optimum use is made of available resources. When budget or other constrictions arise when designing a healthcare building, there may be a need to make choices in terms of priorities. VM aids in the identification of design factors that can be omitted without significant effect on the overall perceived value of the user (Ilayaraja & Eqyaabal, 2015).

For the purpose of this study, value will be considered to be positive impact on patient satisfaction, health outcomes and/or clinical results, improved visitor/patient caretaker experience, reduction in resource waste (including cost and time), improved function and well-being of the healthcare facility workforce staff and/or increased sustainability, Added value will be considered as increase in value resulting from the increase in or addition of one or more factors.

2.4 Factors that add Value to Healthcare Design

There are several diverse factors that have been found to affect the hospital building value chain. Some studies show that efficient logistics and function, effective operative services, and environmental responsibility are essential factors that add value to a hospital building (Hareide, et al. 2015). Other studies suggest that the design of the healthcare environment affects the value chain (Zimring & Ulrich, 2004; Zengul & O'Connor, 2013; Van der Voordt, 2015). Castro et al. (2013) propose dividing criteria evaluating healthcare facility design into environmental, social, functional, and economical dimensions (Castro et al., 2013. p. 419) suggesting that the healthcare facility must be designed based on costs, function and socio-cultural aspects and propose that

the design of both the indoor and outdoor space is incorporated into both the sociocultural and functional categories.

Anåker, et al, (2016) also include the value of the socio-cultural dimension; they propose three factors related to design quality be considered in building design; '(1) environmental sustainability and ecological values, (2) social and cultural interactions and values, and (3) resilience of the engineering and building construction'

A number of factors proposed to add value to healthcare building design have been identified through research studies. This includes factors both directly and indirectly related to building design. Some of these factors are discussed in the following sections.

2.4.1 Traditional Means of Measuring the Value of Architecture

The traditional means of measuring the value of architecture in general has been determine the ratio between function and the whole life cost for that function:

$$\text{Value} = \text{Function} / \text{Whole Life Cost}.$$

Cost is a still priority for healthcare facilities, but it is no longer the primary focus. Porter, (2016); Ho, et al (2017) and Cipriano, (2017) argue that value in healthcare should not be overly concerned with reducing costs, and that the focus should be more on positive outcomes; thus suggesting a patient centered rather than a cost centered focus. Freely, (2010) proposed that value in healthcare is the result of a balance between outcomes and costs, in which patient survival is first outcome concern, followed by quality of life and process of care. Others have proposed that there is no effective way to measure value as a balance of costs and outcomes, as any cost effectiveness analysis can only be applied on a case by case basis if it is to be meaningful to value-based decision making (Savitz & Savitz, 2016). Upcoming sections will identify factors found by research that add value to healthcare facilities. In the following section the role of building design in adding value to a healthcare facility will be explored.

2.4.2 Building Design

When designing a building, the designer considers a combination of regulations, functions, technical needs and aesthetics and develops the design based on these factors (Alfonsi, Capolongo, & Buffoli, 2014), with the goal of creating design quality. Anåker, et al. (2016) suggest that ‘‘Design quality in a healthcare context can be defined from a set of core attributes, including environmental sustainability, social interaction, and cultural values”. Bromley, (2012) proposes that the hospital design reflects “…the sociocultural, economic, professional, and aesthetic priorities prevalent at a given time”.

The role of healthcare facility building design in the value chain of the facility has been noted in several studies (Ulrich et al., 2008; Huisman et al., 2012; Desmet & Pohlmeyer, 2013). Stichler (2001) proposed a healing environment is 'a physical setting … that supports patients and families through the stresses imposed by illness, hospitalization, medical visits, the process of healing … ' (p. 10). Other studies have reported that the design of the physical setting plays an important role in ensuring the well-being of the healthcare facility workforce (Zimring & Ulrich, 2004; Mroczek et al.2005). In 2004, Ho et al. introduced the concept of the 'healthy building' which they defined as a "built environment that encourages positive well-being of human beings. Mohtashami, Mahdavinejad, & Bemanian (2016), claim that the architectural design of healthy buildings should positively impact the occupants 'quality of life, productivity, equity and social inclusion, environmental sustainability, and infrastructure'. A multi-disciplinary group of experts from the Healthy Buildings Program at the Harvard T.H. Chan School of Public Health propose a list of nine foundations of a healthy building which includes factors related to ventilation, air quality, temperature, moisture level, the presence of dust and pests, safety and security, water quality, noise levels, lighting and views.

The topic of how value can be added through building design has been explored in the fields of Corporate Real Estate Management (CREM) and Facility Management (FM) and discussed at the international conferences held by the International Council for Research and Innovation in Building and Construction (CIB) (Van der Voordt, 2015). Other studies

have argued that the building design must incorporate adaptability for it to be sustainable (Nedin, 2013; Støre-Valen et al., 2014). Adaptable buildings possess three key abilities: flexibility, generality, and elasticity (Bjørberg & Verveij, 2009; Hareide et al. 2016). Dewulf and Wright (2009) propose that the value added by a building stems from the extent to which the structure provides flexibility and support for the core business activities during business operations.

Hareide et al. (2016) argue that the definition of value in relation to hospital buildings is a 'building that creates optimal conditions for effective delivery of healthcare services'. How this can be accomplished has been the focus of several studies.

Zhang, Tzortzopoulos & Kagioglou (2019) propose a three design principle conceptual framework they call environment–occupant–health (E-O-H); the principles include are a comfortable environment, a well-functioning healing space, and a relaxing atmosphere.

Zwart & Van der Voordt (2013) proposes that the value of a hospital building lies in its ability to create optimal conditions for effective delivery of healthcare services. However, it has been argued that the management of the building design is an undeveloped area of study (Van der Voordt, 2015). The Center for Health Design assessed healthcare facilities involved in the Pebbles Project ('an evidence-based design process to create healing environments that improve quality of care, promote safety and health, and

increase operational efficiency') and found that incorporating therapeutic design elements such as single-bed rooms and decentralized nursing stations increased building costs, but that these additional costs were recouped within a year of the facility's operation (Zimring & Ulrich, 2004) and were beneficial to patients well-being Reiling , Hughes, and Murphy in Hughes, 2008).

Other factors found to have positive effects on patients' well-being are aspects such as gardens, art, and music (Iyendo Jnr, et al. 2016). The use of single bed patient rooms has been found to add value to the healthcare building value chain (Zimring & Ulrich, 2004; Huisman, et al. 2012). "The standardization of patient rooms and equipment makes routine tasks simpler and decreases errors by staff. When the facility has identical rooms, the nursing staff encounter exactly the same distribution, layout and lighting in every room" (Huisman, et al. 2012). A number of other studies have noted the value added by carefully designed internal and external access routes and points and navigation routes within a healthcare building (Carr, 2017; Devlin, 2014; & Rodrigues, Coelho, & Tavares, 2019).

While some studies have noted diversity in perceptions of the built environment related to differences in gender (Parsons, 2002; Karjalainen, 2007; Zhao & Mourshed, 2017), age, acclimatization (Parsons, 2002), adaptation, health status, and cultural norms (Anåker, et. Al., 2016) etc., others have found little to no difference in patient perceptions based on patient-related characteristics, such as gender, age, ethnicity, socio-economic

status, heath status and expectation (Adhikary, et.al.,2018). In the context of Saudi Arabia, the support for the former perspective outweighs support for the later which may be due to the strong cultural and social gender segregation norms prevalent until the last five years.

In the upcoming section, specific factors found to add value to a healthcare facility are discussed.

2.4.3 Location/Accessibility

One factor related to the value stream in healthcare facilities is transportation routes, or the routes used for the movement of components such as people, medical equipment and supplies, and materials etc. around the healthcare building. A building design which has transportation routes that waste time and energy has less value than one in which the building is designed to streamline movement (Carr, 2017; Devlin,2014; & Rodrigues, Coelho, & Tavares, 2019) and one that uses lean practices (Swallmeh, 2014).

A healthcare facility located so that it provides simple and quick access to all users, including those with urgent, secondary, tertiary and quaternary medical needs add value (Ahmadi-Javid, Seyedi, & Syam, 2017). *'The site of any healthcare facility should be convenient both to the community and to service vehicles, including fire appliances, ambulances and other emergency vehicles'* (Health Building Note 00-01, pg. 16 section 4.17, 2014).

A building which patients and staff can easily navigate and that is clearly marked can positively impact patient wellbeing and staff productivity (Carr, 2017) . Devlin (2014) and Rodrigues, Coelho, & Tavares, (2019) proposed the need for universal healthcare symbols to aid in healthcare facility navigation, particularly for users with cognitive and/or visual challenges and to aid with cross cultural issues. The UK Department of Health claims that *'the use of colour and art to identify particular routes and rooms can help to reduce the number of signs required'* (Health Building Note 00-01, pg. 25 section 5.51, 2014).

Carr (2017) argues that the building design should promote staff efficiency by minimizing travel distance between commonly visited spaces, locate support spaces so that they can be shared by adjacent functional areas, and group or combine areas with similar functional needs. Thus, suggesting that the location of departments such as the ER and ICU, where there are often patients in need of critical attention that need to be moved to other departments, should located so the transport of said patients is streamlined and facilitated to areas such as operating theatres and diagnostic departments.

2.4.4 Medical Factors

The design of a facility/structure and all of its fixed and moveable components can impact the health and safety of employees, patients, and families (American Institute of Architects, 2001). Mosadeghrad (2014) suggests that value is added when there is cooperation between the patient and the healthcare provider in a supportive environment.

Huisman et al., 2012; Desmet & Pohlmeyer, 2013). Stichler (2001) propose that such an environment can be provided through 'a physical setting … that supports patients and families …' (p. 10).

2.4.5 Ease of Staff Communication and Collaboration

Studies have shown that the ability to quickly and efficiently form multidisciplinary teams within a hospital can improve communication amongst healthcare workers, reduce risks, improve outcomes, decrease length of patient stay, and positively impact staff and patient satisfaction (Epstein, 2014). Gharaveis, Hamilton, & Pati (2017) found that layout design, visibility, and ease of accessibility are the design factors which have the greatest effect on communication and multi-disciplinary teamwork in healthcare facilities. This is of import since other research has suggested that that a large percentage of the mishaps that take place in healthcare facilities result from a breakdown in communication among members of health care teams (Vermeir, et. al, 2015). Poor communication among staff in healthcare facilities can result in negative outcomes such as lack of continuity of care, impact patient safety, and patient dissatisfaction; in addition it can result in inefficient use of resources such as equipment used to conduct unnecessary investigations and staff time all of which can have negative economic implications (Vermeir, et. al, 2015).

2.4.6 Ease of Information Sharing

In their study, Hillary, et al. (2016), found that an electronic health records system to share information easily and efficiently between healthcare staff was of benefit. Hospital

facilities are IT-dependent and, as with the other services, it is vital that connectivity is addressed (Health Building Note 00-01, pg. 16 section 4.25, 2014). The Saudi Arabian Government's Vision 2030 Health Sector Transformation Strategy notes the need to: 'Harness technology, the internet and mobile telephony, computational power and interoperability, big data and analysis…' and to '*Develop the information systems, distributed governance systems, accounting systems, and the professional, employment and communication practices…'*. Bardach, Real & Bardach (2017) found that limitations in computer availability, documentation complexity, and sluggish sign-in processes formed barriers to effective and timely communication in a healthcare facility.

In their exploratory study to identify healthcare professionals' perspectives on the "ideal" inter-professional round for patients Verhaegh, et.al (2017) noted the importance of taking into consideration the way in which spatial structures can affect communication and collaboration between the healthcare team and the patient.

2.4.7 Operational

A well-designed patient-centered supply chain will reduce the number of supply room visits, saving time and reducing delays, and will engage supply technicians to handle supply delivery freeing caretakers' time to be with patients. One study found that 'service providers spent 12% of their time working around internal supply chain problems' (Tucker , Heisler , & Janisse, 2012).

Hospital facilities require an efficient logistics system, for the handling of wastes, supplies, laundry, food and recyclables (Carr, 2017). Tortorella, et al. (2016), propose value stream mapping (VSM) to add value to internal supply logistics.

2.4.8 Procedural

Gurses and Carayon (2007), argued the need to modify care processes to reduce inefficiencies caused by distractions from family members, busy working conditions, and delays in obtaining supplies and equipment and in seeing new medical orders.

Sampalli, et al (2015), propose a patient centric approach that includes a LEAN methodology of Value Stream Mapping (VSM) to reduce patient wait times and thus add value. The LEAN methodology provides guidelines, principles and practices to engage in process improvement that results in reduced waste (cost, time, etc.).This has been effective in reducing patient wait times, and improving system performance by removing time wasting activities from processes (Swallmeh, 2014). The design of the building can aid in this by enabling multiple procedures to be accomplished in a single space through the use of technology (i.e. patient appointment for a test or procedure and the insurance carrier approval in a single area to avoid the need for patient to walk long distances).

2.4.9 Economic

Building design costs are generally viewed as the costs to design and initially construct the building, rather than the potential long term costs. Using EBD to create a healing environment can save money in the long term. The initial costs of building or renovating an existing healthcare structure to provide added value can result in long term savings for the organization (Gurses and Carayon, 2007). Jasuta (2016), argues that a 'rolling capital approach' will serve to align operational performance and capital investment, enable accurate forecasting of future expenditures, control cash outflows, and reduce risk related to patient care, employees and overall stakeholder satisfaction.

The cost of medical care is a global issue, and is of particular concern in countries where the health industry falls within the private sector. Porter, (2009) notes the need in such cases for universal insurance coverage, which can be achieved by reforming and regulating the system and makes quality healthcare available to all. While the issue of the availability of insurance coverage is not directly related to building design, it is a factor which can affect patients' choice of hospital. The requirement for employees to be given medical insurance by their employer in Saudi Arabia is relatively recent having been initiated in September 2016 (Walston, Al-Harbi,Al-Omar, 2008) and coincided with a move towards increased privatization of the healthcare industry.

2.4.10 Policy

Marcotte, Moriates, & Milstein (2014), argue the need for a professional organization to develop and regulate standards for medical specialties to establish trust with physicians. Regulations related to healthcare facilities vary from one country to another. Policy related

to allowing relatives/caretakers to remain with patients can also be of value; according to the UK Department of Health, research findings show that allowing relatives to remain with a patient and providing facilities to accommodate them can result in several benefits, including reductions in nurse-call button activity, and in patient falls (Health Building Note 00-01, pg. 36, 2014).

2.4.11 Staff care and Attitude

In their study on patient perspectives, Moore, et al. (2016) , found that patients valued staff who they perceived as courteous, attentive listeners, patient, caring, respectful, and understanding of their needs. For this to occur, effective communication between patient and caregiver is vital. Almutairi (2015), argued that the large number of non-Arabic speaking healthcare workers impeded effective communication and may result in a negative impact on the quality of patients' healthcare as increase safety risks.

Staff attitudes and level to which they are motivated to perform are directly related to their well-being, and staff well-being is impacted by building design; studies have found that the design of the physical setting plays an important role in ensuring the well-being of the healthcare facility workforce (Zimring & Ulrich, 2004; Mroczek et al.2005).

2.4.12 Aesthetics

The aesthetic appeal of a healthcare facility has a positive association with employee satisfaction and work relationships (Varni, et al., 2004). The UK Department of Health

claims research shows increased positive patient outcomes when the design incorporates 'natural light, elements of nature, soothing colours, meaningful and varying stimuli, peaceful sounds, pleasant views and a sense of beauty' (Health Building Note 00-01, pg. 28, 2014). Studies suggest that providing patients with natural light (Carr, 2017; Zhao & Mourshed, 2017), artwork (Carr, 2017; Health Building Note 00-01, pg. 25 section 5.53, 2014), outdoor views (Carr, 2017), providing 'photo murals of nature scenes are helpful where outdoor views are not available' (Carr, 2017) and spatial and seating design (Zhao & Mourshed, 2017). Research shows that choice of color can affect patient mood; blue and green are found to promote relaxation and balance, while yellow and orange add energy (The Advisory Board Company. 2007).

The UK Department of Health proposes that: *'the selection of colours and reflectance's can have a significant impact on the lighting within the room and will need to be coordinated with the lighting design'* (Health Building Note 00-01, pg. 24 section 5.36, 2014).

2.4.13 Cultural and Spiritual

Different countries and cultural groups have diverse spiritual, cultural and normative values. These values guide behavior of individuals and groups in all aspects of their lives. Hospital buildings need to reflect the unique attitudes, interests, concerns and values of

the place and people they are located in (Bromley, 2012). This concurs with the recommendations of the UK Department of Health that *'In clinical and waiting areas, planning decisions should take account of patient culture and preferences in terms of privacy, modesty and same-sex accommodation*.' (Health Building Note 00-01, pg. 23 section 5.26, 2014).

Cruz, et al. (2018) found that an environment which is conducive to spirituality improves patient, nurse and organizational outcomes. Ahmad, Singh , Kamal, and Shaikh (2020) note that the Planetree International Designation Criteria, which was developed with the goal of developing comprehensive framework for the implementation of patient-centered care, includes consideration of the mind, body and spirit of patients, families and staff when planning and designing a healthcare facility.

The UK Department of Health suggests that spiritual spaces can serve diverse needs including providing spaces for personal contemplation, religious needs, and counseling (Health Building Note 00-01, pg.48, 2014). In pre-dominantly Muslim Saudi Arabia, this would encompass the need for mosques for the general population to pray the five daily prayers, and signage that signifies the direction of Mecca in rooms for prayer in place.

2.4.14 Risk and Safety

Studies have reported that factors related to building design and the built environment—can have a positive or negative impact on risk and patient safety (Joseph & Rashid, 2008;

Ulrich et al., 2008). Silvis (2012) proposes '*an urgent need for a well-defined and standard methodology to identify and eliminate built environment latent conditions that impact patient safety during the planning, design, and construction of healthcare facilities'*. A hospital building designed with consideration of how the design could affect safety and quality can improve patient outcomes, promote healing, and reduce costs, thus adding to the value chain (Gurses and Carayon, 2007) and *'Virtually any characteristic of the environment can have a supportive or detrimental effect on human performance and hence on patient safety'* (Dickerman and Barach, 2008).

Zhao, Mourshed and Wright (2009) propose that the layout design of healthcare facilities should be based on staff and patient health and safety assessments as this will benefit the staff, and allow for better patient supervision and a reduction of potential medical errors. Features of hospital design found in research to impact patient safety include 'noise, air quality, lighting conditions, patient room design, unit layout, and several other interior design features' (Joseph & Rashid, 2008).

Dickerman and Barach (2008), argue that there is strong evidence the physical environment design in healthcare facilities can be a factor related to an increase in medical errors, rates of infection and injuries from falls, slower patient recovery and higher nurse turnover. Another factor related to patient safety is communication efficiency between caregiver and patient (Almutairi, 2015). Joseph & Rashid (2008) propose that

some of these factors are ‘embedded within systems as a result of wrong decisions made by designers, builders, procedure writers and top level management’.

In the following section, the need for facility design to fit specific needs is discussed.

2.5 The Need for Bespoke Design

EBD research does not provide a ‘one size fits all’ solution for healthcare building design, and EBD solutions are not to be considered universal to all design for a particular industry, but are unique “ad hoc” solutions that apply in a specific context and situation (Alfonsi, Capolongo, & Buffoli, 2014).Van Hoof et al. (2015) argue that the complexity of healthcare building design stems in part from the interdisciplinary character of the design process, which requires the involvement of a number of perspectives with diverse concepts of value, including those responsible for the design, construction, operation and maintenance of the building over time, and that this process becomes more complicated when the building is intended for specific user groups.

The design of any space or building must suit the needs and perceived values of the people who inhabit it. Zeliotis (2017), noted the need for ‘bespoke design that meets the needs of specific professionals and patients’ in cancer healthcare facilities. The design of cancer facilities must be based on EBD with input from key stakeholders (Berry, et al., 2020) and with consideration of the clinical requirements of diagnosis, treatment and care, optimize patient wellbeing and positive outcomes (Zeliotis, 2017). However, some studies have shown that the cancer patient experience is not a primary concern during the design process, and that the design and spatial layout of cancer care facilities are

based more on how staff can efficiently produce medical care and prioritizes the comfort and ease of staff over that of the patients (Martin, et. al., 2015).

Facility design should serve to *'improve the patient experience, offer options for urgent care, maximize infection control, support and streamline the work of multidisciplinary teams, integrate research and teaching, incorporate palliative care, and look beyond mere diagnosis and treatment to patient wellness—all tailored to each cancer center's patient population and logistical and financial constraints'* (Berry, et. al. , 2020).

In their systematic review of literature on the impact of environmental design on cancer care Gharaveis, A., and Kazem-Zadeh, M., (2018) found that accessibility to the healing landscape can enhance mood, satisfaction, and communication, and reduce stress level for both patients and staff, and that reduction of background noise level, reduction or reinfection, high levels of privacy, accessibility to nature, access to an external view, and increased unit size all add value to cancer healthcare facilities.

The upcoming section explores healthcare building design in the Saudi context. This includes relevant national codes and regulations.

2.6 Healthcare Building Design in Saudi Arabia

The laws, standards and regulations for healthcare building design are specific to the geographical area and economy in which they are built. In Saudi Arabia, the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) is the responsible body for the mandatory accreditation of all healthcare facilities in the Kingdom. These standards are categorized into three major types: structural standards, activity and procedural standards, and outcome standards, of which only the first is related to the structural design of healthcare buildings.

The Saudi building code is defined as 'the group of terms and requirements as of laws, regulations and annexes related to buildings and constructions to ensure safety and public health'. The code was drafted based on international codes from the United States of America, Canada, Australia, Europe and other Arab codes and that of the International Building Code (IBC) published by the International Code Council (ICC).

Article 2 of the Saudi Building code (SBC) (Issued June 2018, and amended Oct. 2019) outlines its aims as …'to establish the minimum terms and requirements that achieve safety and public health through the durability and stability of buildings and facilities and facilitate access to them and provide a healthy environment, adequate lighting and ventilation, rationalization of water and energy, protection of life and property from the risks of fire, earthquakes and other risks associated with buildings".

Article 3 of the Saudi Arabian Law of Private Health Institutions states that the … 'premises of a private health institution shall conform to the sanitary conditions as well as architectural specifications and proper distribution. It shall contain necessary

furniture, medical and nonmedical devices and equipment. The institution shall have a medical waste disposal system, an infection control system and a health information system' (2017).

Under Article 3 the following criteria and conditions are established:

1. Fulfilment of all technical and engineering specifications required by regulating authorities.
2. Medical devices that comply with approved standards.
3. All technical and engineering drawings related to the construction or modification of the … premises must be reviewed and approved by the Ministry or by one of the approved consulting engineering offices. Stages of construction and preparation of the required reports must be submitted and are subject to final technical approval prior to issuance of a license.
4. The site shall conform to the conditions of the region or municipality in which it is located.
5. Safety and fire fighting requirements shall be available ….
8. A suitable place shall be provided for patients' records …if records are totally electronic this is not required.
10. Suitable places should be reserved for men while a separate waiting area is dedicated for women with adequate furniture and cold water as well as adequate and suitable toilets.
11. The premises should have entrances and exits for people with special needs which facilitate their movement inside the premises.

12. Billboard signs should be placed within the institution to clarify … locations of clinics, departments and other facilities of the institution.

These regulations show that private healthcare institutions in Saudi Arabia are required to conform to regulations related to design features, such as accessibility and signage for wayfinding, that have been shown in the literature to add value to the healthcare building's design. In addition, there are also requirements related to culturally specific factors such as the provision of gender segregated waiting areas.

On the official website for The Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI), it states:

> *'CBAHI believes that the achievement of higher level quality and patient safety in healthcare facilities is an integrated comprehensive process that not only relates to clinical care services provided by the medical staff but extends to all components of healthcare service, including standards, construction specifications, design, and operation systems'.*

Several studies have reported factors related to building design in relation to self-reported level of patient satisfaction at Saudi Healthcare facilities. In her (2014) study entitled 'Patient Satisfaction with Primary Health Care in Jubail City, Saudi Arabia', Almoajel found that patients reported a noted preference for facilities located within the city centre over those located elsewhere. Mohamed, et al., (2015) in their study on 'Patients' Satisfaction with Primary Health Care Centers' Services, Majmaah, Kingdom of Saudi Arabia', found

that the most common reason given by patients for their dissatisfaction was unsuitable buildings (29%).

In a study on patient satisfaction with health care services in southern Saudi Arabia, results showed high levels of patient satisfaction related to privacy and ease of movement around the hospital, and low levels of satisfaction with noise level and cleanliness (Almutairi, et.al. 2018). For example, in their study, Ahmad, Singh , Kamal, and Shaikh (2020) propose that there is a need for balance within healthcare facilities in Saudi Arabia between the need for patient/staff safety and the importance of comfort, privacy and modesty that facilitate the process of healing.

The structure and function of healthcare facilities are strongly impacted by social and cultural norms and traditions. In conservative Saudi Arabia, hospital design has traditionally included separate waiting rooms for men and women, which requires the design and allocation of space with appropriate visibility barriers to account for it. The UK Department of Health recommends the:

> '*Preservation of patients' privacy and dignity, particularly at points of transfer between changing, subwaiting and treatment facilities, should be given high priority, and in some cases men and women should be segregated.'* Going on to say that this can be accomplished ' *operationally, by providing separate facilities*

or by designing for flexibility' (Health Building Note 00-01, pg. 23 section 5.26, 2014),

Communication problems due to language differences between patient and caregivers can also be an issue (Almutairi, 2015; Alshammari, Duff, & Guilhermino, 2019), as can cultural and religious differences (Alshammari, Duff, & Guilhermino, 2019) and these can lead to patient dissatisfaction, poor comprehension of and adherence to patient requests, and lower quality of care, in addition to miscommunication which has been related to increased mistakes in medical treatment and procedures.

One factor that should be considered in healthcare facility design in general in the culture of the Middle East is accounting for a larger number of visitors due to the closeness of extended family in the design of patient rooms and traffic flows. Single patient rooms have been found to add value to healthcare facilities; in Saudi Arabia, where gender segregation of non-closely related family members is still a norm, single patient rooms are a culturally desired feature. In addition, single patient rooms can reduce the effect on others of the level of noise and other disturbances related to the high number of visitors that come to see the patient while he/she is in the hospital. Others have proposed that patient room size and design, accommodation for caretakers and family within the patient room add value to Saudi healthcare facilities (Ahmad, Singh , Kamal, and Shaikh, 2020).

In their 2018 study, Cruz, et al. found that an environment which is conducive to spirituality improves patient, nurse and organizational outcomes and found a need to 'improve the spiritual climate' in Saudi hospitals. The culture is heavily influenced by the predominantly Muslim population, and spaces in which to perform the 5 daily prayers are integral to most public and larger private buildings including healthcare facilities.

Almutairi and Mahaman (2014) conducted a systematic review of quality of care in Saudi Arabia, and reported that the ability of health care providers to educate patients' families about patient care was impeded by the healthcare workers workloads, language barriers, and cultural differences. In another study focused on how person centered care can impact healthcare outcomes in the context of Saudi Arabia, Ahmad, Singh, Kamal, and Shaikh (2020) proposed a seven criteria design framework for the design of healthcare facilities in Saudi Arabia. The criteria are as follows:

1. The incorporation of evidence based principles into the design process with the adaptability to be consistently updated as needed to positively impact safety and security of patients, visitors, working staff and management.

2. To give patients control over their personal environment in terms of visual privacy, lighting, noise level and temperature.

3. Ease of navigation via clearly marked pathways for patients, visitors and staff, with 'visual way findings makers such as architectural details, pattern or artwork, kiosks and handheld maps/digital directory' that negate any

mobility limitations within the facility due to language or physical ability issues.

4. Clear and easy access to the building itself with sufficient parking close to entry point, or valet or shuttle services to facilitate transportation to and from the building, and the availability of sufficient wheelchairs at entry points to meet patient/resident needs.

5. To accommodate for individual's privacy needs in a culturally appropriate way that provides for the dignity and modesty of staff and patients 'particularly in common areas, check-in registration, check-out/billing, patient/resident rooms'.

6. To provide areas with natural scenery such as indoor/outdoor or roof gardens for the use of patients and staff.

7. To provide aesthetically appealing lighting conducive to a healing environment that provides high levels of safety and security for patients/staff and visitors.

It can be noted that this framework encompasses many of the value adding factors found in the literature to add user value to healthcare facilities in general, with the addition of factors specific to Saudi Arabia.

The diversity in users and their perspectives on value, in addition to the need for culturally specific input on value added in design support a need for the multiuser participation in the design process discussed in the following section.

2.7 The Need for Multiuser Participation in the Design Process

The need for the inclusion of diverse users in the healthcare facility pre-design phase of the design process has been suggested by several studies (McGinley & Dong, 2011; Castro, Mateus, & Bragança, 2012; Nordwall & Olofsson, 2013; Payne et al. 2015). In the pre-design phase research and design are synthesized through the analytical application of multi-user input to gain insight into design needs. Elf, Fröst, Lindahl, & Wijk, (2015) suggest that the design process should be the result of shared-decision making and collaborative planning between representatives from healthcare, construction sector and architecture , and that those decisions should be based on based on evidence and end-users' perspectives.

Nordwall & Olofsson (2013) suggest that by gaining insight from end users healthcare building designers can understand the design elements that add the greatest value for the end user. The need for multiuser input has also been acknowledged by the UK Department of health:

> '… *information on the size of rooms and circulation space within departments … should be thoroughly reviewed by the clinicians and users – including patients and the public – together with technical advisers to establish the organisation's brief for the spatial requirements'* (Health Building Note 00-01, pg. 22 section 5.18, 2014).

This suggests the need for an interpretive approach using data collected from users within the specific socio-historic context on their subjective perceptions, which leads to a need for means to measure added value. Some of the means of measuring value in healthcare facilities are discussed in the upcoming section.

2.8 Measuring Value in Healthcare Facilities/Buildings

The E-O-H proposed by Zhang, Tzortzopoulos & Kagioglou (2018), assumes that there is no single characteristic in healthcare building design which alone will achieve the full potential added benefits, that when one aspect of the building design has a negative aspect, that it will negate the benefits from the others, and that positive design characteristics result in a cumulative beneficial effect. This suggests the need to compare the weighted added values of various design characteristics in order to determine which of the characteristics add greater value to the healthcare building design.

Building design decisions can be complex due to the high number of value drivers over the course of the project and the number of stakeholders with diverse perspectives of value (McGinley & Dong, 2011; Hunjak, & Strahonja, 2014). Thus, it is beneficial to be able to prioritize the design factors that give universal added value. A proposed means of determining value in mathematical terms is to assess the relationships amongst needs, functions, resources and costs (Kelly et al., 2008; Institute of Value Management, 2015).

Multiple Criteria Decision Making (MCDC) tools are a means of assessing these relationships.

There are several multi criteria decision making methods that can be applied to analyze the relationship amongst design factors. The Analytical Hierarchy Process (AHP) is a Multiple Criteria Decision Making (MCDC) method, developed by Saaty (1980) that is used to assess the priority or weights among the criteria and alternatives based on the comparative judgments of the chosen participants.

The value of the AHP method lies in how it facilitates the combined evaluation of abstract and the concrete criteria, the performance of a consistency analysis, the ease with which the criteria and sub-criteria hierarchy can be defined, and the provision of clear and easily understood results are that enable decision making in complex situations (Harputlugil et al., 2014).

2.10 Literature Synthesis

The literature review was undertaken in order to determine factors which previous related studies had identified as adding value to healthcare facilities, thus providing a base which this research could evaluate build on in the specific context of the Saudi culture. Based on the review of literature fourteen factors that were identified as adding value to healthcare facilities. These included factors directly and indirectly related to the building design. The list of factors was used to develop the first survey instrument which was

designed to validate the factors extracted from the literature review within the Saudi context.

Value Adding Factors Derived from the Literature Review	Directly Related to Building Design	Indirectly Related to Building Design
1. Location/Accessibility	X	X
2. Building Design	X	
3. Medical		X
4. Communication and Collaboration		X
5. IT Infrastructure	X	X
6. Operational	X	X
7. Procedural		X
8. Economic	X	X
9. Policy		X
10. Patient's Room	X	
11. Staff care and Attitude		X
12. Cultural	X	X
13. Spiritual	X	X
14. Risk and Safety	X	X

Table 1Synthesis of Factors Derived from Literature Review

2.11 Chapter Summary

In this chapter the concept of adding value and the importance of EBD in the design of healthcare facilities has been discussed. Specific factors found to add value to building design are outlined, along with an introduction to the Saudi Healthcare Industry, legal factors related to Healthcare building design in Saudi Arabia, and the need for a multi-user perspective to determine which factors add value. This impacted the subsequent steps of the study as the insight into the factors found in the literature to add value to a healthcare facility were used to form the first survey instrument.

In the following chapter, the research methodology, philosophy and approach are outlined, and the means used to gather and analyze the primary data are explained.

Chapter III

Research Methodology

Introduction to Chapter 3

A research methodology is the process which is undertaken to achieve the aims and objectives of a research study (Frey, 2018). The process is based on the theoretical and philosophical assumptions held about the research. Method refers to the means and processes used to gather the data and to analyse the generated data (Frey, 2018). To determine the research methodology, the researcher must make decisions related to research strategies, methods and approaches, as seen in figure 3.1 below, Saunder's (2016) Research Onion.

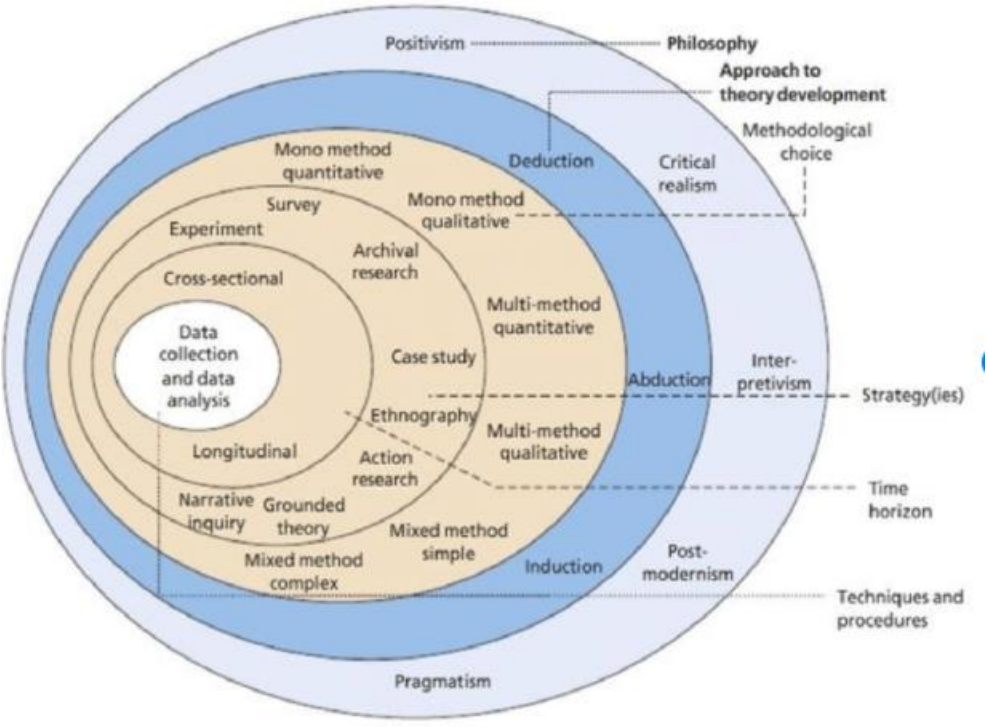


Figure 2 Research Onion (Saunders, 2016)

In this chapter, the research strategy, the research method, the research approach, data collection methods, sample selection, the research process, the type of data analysis, the ethical considerations and the research limitations are outlined.

3.1 Research Philosophy

Research Methodology refers to the overall approach to of research process, from the theoretical underpinnings to the collection and analysis of data (Collis & Hussey, 2014). Selecting the methodology best suited to answer the research questions and achieving the research objectives is necessary to ensure validity and reliability of results. This necessitates an understanding of the philosophical foundations of the research to develop the most appropriate to the research. This study adopts a critical realism philosophy; one of the major assumptions of the study is that individuals have diverse perceptions of value, and that these perceptions are impacted by the individual's culture and experience.

The three main dimensions of research philosophy are Epistemology, Ontology, and Axiology which serve to position the research from the philosophical perspective (Collis & Hussey, 2016).

Epistemology is related to how knowledge came to be known, and the nature and scope of knowledge (what counts as knowledge and knowing) (Levers, 2013) .

Ontology is related to the nature of reality and of what really exists (being and becoming

Axiology is related to the role of values and of the researcher in the generation of new knowledge. It encompasses ethics, aesthetics and other forms of value (Collins & Hussey, 2014).

The epistemological, ontological and axiological stances must show consistency as shown in the figure below:

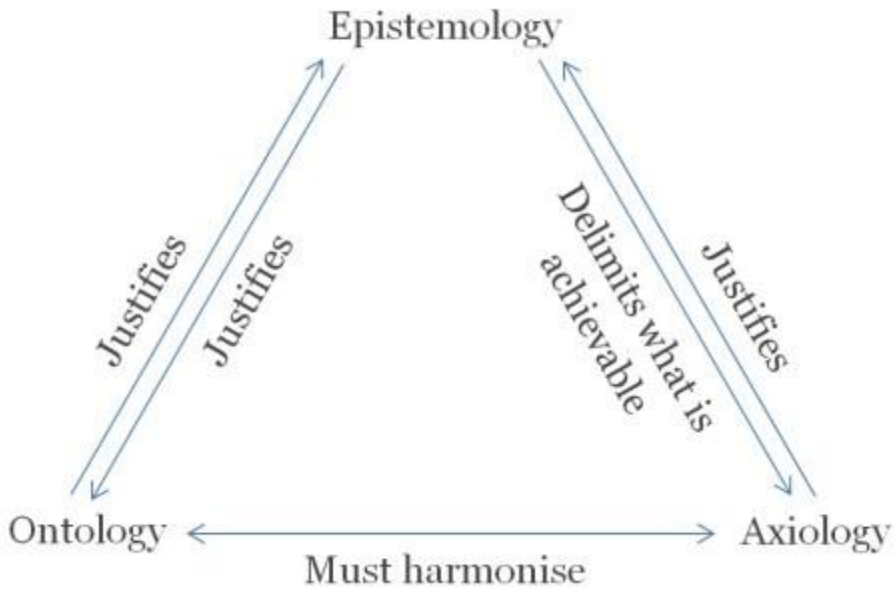


Figure 3 Paradigmatic Patterson and Williams 1998 as adapted from Laudan 1964)

3.1.1 Epistemology

Epistemology is the philosophy of how we know what we know, and is concerned with the relationship between the knower and the knowledge itself. Two contrasting epistemological viewpoints are Positivism and Social Constructivism (Levers, 2013).

The positivist approach limits the role of the researcher to data collection and interpretation. Thus objective, value free observations lead to quantifiable results which can undergo statistical analyses.

The Social Constructivist approach proposes that reality is determined by people rather than by external factors, and so is subjective rather than objective. Learning is the result of social interaction. The data gathered often leads to qualitative results. This is integral to the premise of this research as it will evaluate subjective data on the premise that it will be in some way unique to the social and cultural context the data is extracted from (Levers, 2013).

This research study aims to develop a framework for the design of healthcare buildings in Saudi Arabia based on the perceived value of design factors by a multi-user group. Value itself is subjective, and therefore this research leans more towards social constructivism.

3.1.2 Ontology

Ontology is concerned with the nature of the reality (Saunders et. al. 2007). This is related to how researchers believe that the world operates. There are two main ontological perspectives, Objectivism and Subjectivism. Objectivism holds that social

reality exists independent of any human bias and that the observed and the observer have no influence on one another. On the other hand, subjectivism holds the view that realities are constructed and depend on the independent observer (Levers, 2013). This research seeks to gain insight into the combined individual perceptions of a multiuser group, and therefore, leans towards the subjective view.

3.1.3 Axiology

Axiology is concerned with people's perceptions about value, including those of the researcher, and how these perceptions or judgments influence how they process social inquiry. The axiological stance of a research can be value free or value laden. If it is value free, the researcher has an objective stance and is independent from the data. If it is value laden, the researcher has a subjective stance due being part of what is researched and/or cultural experiences and upbringings (Levers, 2013). This research seeks to identify design features that add value within a specific cultural context, the same culture of the researcher, and therefore will be value laden.

3.2 Research Approach

There are four components that make up the research approach; these are the purpose of the research, the process of the research, the logic of the research and the outcome of the research. These four components form the structure upon with the research is based.

- Purpose of Research can be Exploratory, Explanatory or Descriptive.
- Process of Research can be either Quantitative or Qualitative or mixed.
- Logic of Research can be either Deductive or Inductive.
- Outcome of Research can be either Applied or Basic Research (Rajasekar, Philominathan, & Chinnathambi, 2013).

3.2.1 Purpose of Research

The research purpose can be exploratory, explanatory or descriptive. Exploratory research is the initial research into a hypothesis. Descriptive research builds on exploratory research to gain greater insight into the initial findings. Explanatory research seeks to find explanations for something that has not previously been studied (Given, 2008) . As this research seeks to gain greater insight into how value is added to healthcare facilities through building design based initially on previous studies reported in the literature, then on validation of the factors extracted from the literature study, and finally on weighted comparison of those features this research is sequential exploratory.

3.2.2 Research Process: a Mixed Method Approach

A mixed methods research approach is the collection and analysis of both quantitative and qualitative data during a single study, either concurrently or sequentially (Creswell & Cresswell, 2018). Due to the noted limitations of both the qualitative and quantitative methods many researchers are conducting mixed method studies that explicitly combine both approaches.

In a mixed method study quantitative methods can be used to confirm the findings of qualitative data and correlate between them.

Creswell, Plano Clark, Gutmann and Hanson (2003) propose six mixed methods designs based on four criteria: the implementation order of data collection (parallel or sequential), the priority given to the quantitative and qualitative research (one taking priority over the other or both being of equal weight) , the stage in the research in which the qualitative and quantitative methods are undertaken, and the use of a transformational value or action-oriented theoretical perspective in the study (framework, advocacy, ideology).

The table below outlines the six mixed method typologies:

Design Form	Order of Implementation	Assignment of Priority	Stage of Implementation	Results in a Theoretical Perspective
Sequential Explanatory	**Quantitative then Qualitative**	**Usually Quantitative, but can be Qualitative or Equal**	**Interpretation**	**Possibly**

Sequential Exploratory	**Qualitative then Quantitative**	**Usually Qualitative, but can be Quantitative or Equal**	**Interpretation**	**Possibly**
Sequential Transformation	**In either order**	**Quantitative. Qualitative or Equal**	**Interpretation**	**Definitely**
Concurrent Triangulation	**Parallel collection of qualitative and quantitative data**	**Usually Equal but can be Quantitative or Qualitative**	**Interpretation or Analysis**	**Possibly**
Concurrent Nested	**Parallel collection of qualitative and quantitative data**	**Quantitative or Qualitative**	**Analysis**	**Possibly**
Concurrent Transformative	**Parallel collection of qualitative and quantitative data**	**Quantitative. Qualitative or Equal**	**Usually Analysis but can be Interpretation**	**Definitely**

Table 2 Mixed Method Typologies (Adapted by Author from Creswell, Plano Clark, Gutmann and Hanson, 2003)

3.2.3 Logic of Research

The logic of the research can be either deductive or inductive.

Deductive (Quantitative)

Pre-established theories can be validated through the deductive or 'top down approach'; in this approach a pre-developed theory is used to form a hypothesis which is then tested by observation and finally used to confirm the hypothesis. This approach results in quantitative data (Rajasekar, Philominathan, & Chinnathambi, 2013). However, qualitative methods are hard to generalise to a larger population (Recker, 2013), and are more suitable for smaller samples.

The interpretive deductive approach is based on the assumption that rather than being singular or objective that a group's social reality is shaped by human experiences and social and cultural contexts and is therefore best studied within that group's own socio-historic context through integration of the subjective perceptions of the participants.

Inductive (Qualitative) Approach

In an inductive or 'bottom up approach' a new theory is developed from generated data; this approach begins with an observation from which a pattern is derived, a hypothesis is developed and finally theory is proposed. This approach results in qualitative data (Rajasekar, Philominathan, & Chinnathambi, 2013).

This study will use an inductive approach. The data generated from the literature review, and the first and second survey instruments will be used to develop a proposed framework.

3.2.4 Outcome of Research

The outcome of the research can be either applied or basic. The outcome of this research is basic as there will be no application of the findings at this time.

3.4 Research Activities

This section outlines the details of the primary research activities that were carried out during each of the research phases. Each research activity is explained in terms of three parameters – the need for the research activity, the method adopted and its expected outcome. These activities are outlined in the chart below.

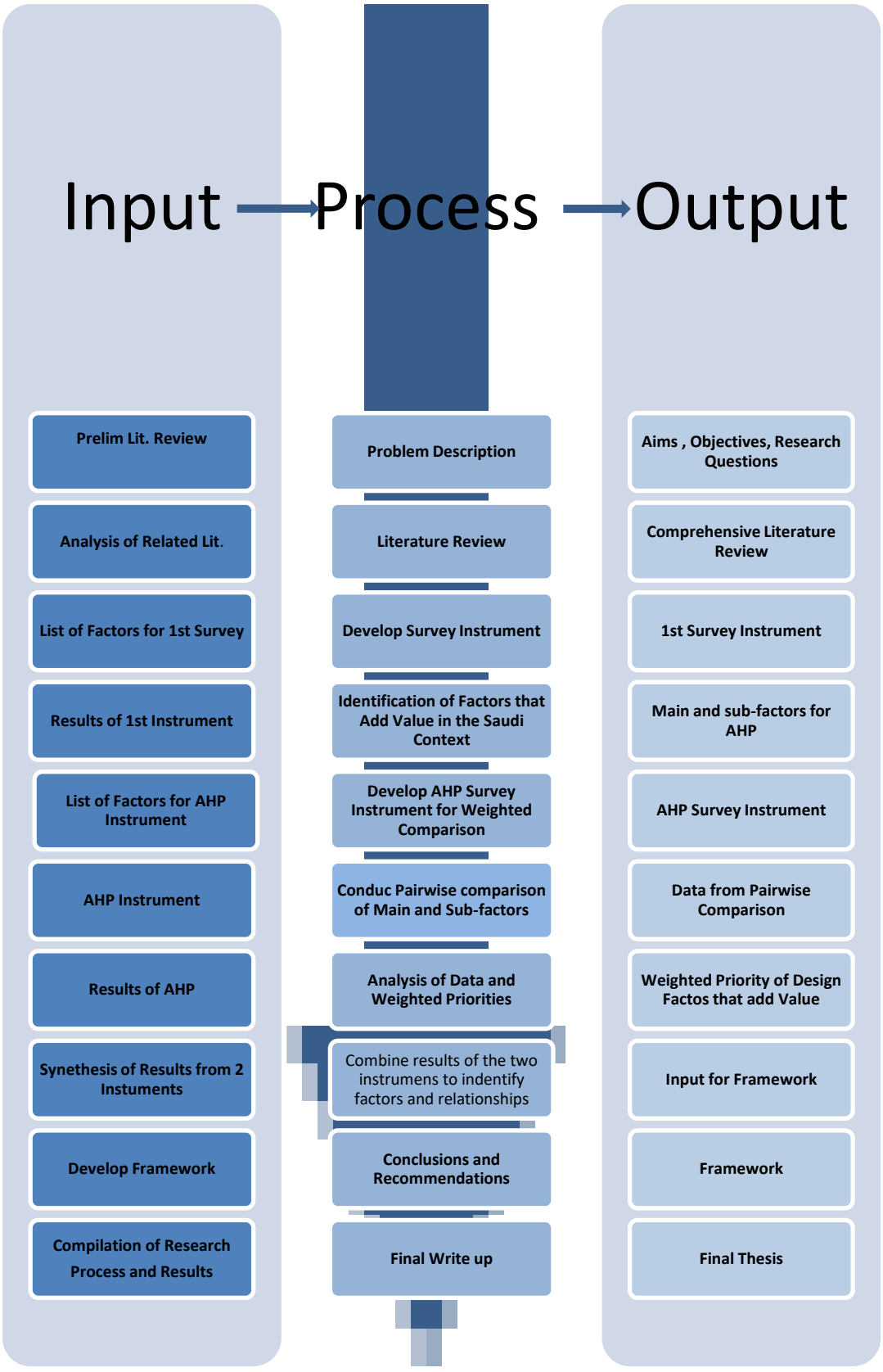


Figure 4 Research Process and Activities

The research activities were sequential, beginning with the literature review which serves to identify factors found by research to add value to healthcare facilities. These factors were then used to develop a survey instrument which was designed to validate the factors determined by the literature review within the Saudi context. The results of this survey instrument were in turn used to form an AHP pairwise comparison survey to determine the relative weights of each of the validated factors, The synthesized results of the literature review and the first and second surveys were then used to develop a framework for adding value through building design to Saudi healthcare facilities. Validation of the framework was not conducted as the factors were validated in the first instrument, and the weighted comparison of the factors in the second instrument were validated by the consistency ratio. Thus the research was undertaken as a sequential process with one step leading to another.

3.4.1 Secondary Data Collection: Literature review sources

A review of relevant literature was conducted as a part of the secondary study. The review served to provide the knowledge needed to develop the instruments used for the primary data collection. This research used online sources and the university library to search for the relevant material using the keywords such as healthcare facility value management , evidence based design, and value added through design, Sources include related previous studies, books, scholarly articles, websites, and government publications. The literature review helped identify the factors used to construct the primary data collection questionnaire instruments. Although the majority of literature review was conducted at the beginning of this study, some parts were continued over the course of the research.

The literature review is the foundation on which the rest of the research is based, and the knowledge gained of the factors proposed to add value to a healthcare facility was used to develop the research instruments for primary data collection. The information collected was reported in the Literature Review in Chapter 2.

3.4.2 Primary Data Collection

This study used a mixed methods approach which incorporates both deductive and inductive approaches and results in both qualitative and quantitative data. This involved the identification of factors through review of literature, an instrument to gain expert's opinion on the variables, and data obtained from an AHP questionnaire to conduct an interpretive study of the participants' perceptions of the value added by specific design elements to healthcare buildings in Saudi Arabia. The design form for the mixed methods approach was sequential exploratory. Priority was given to the quantitative data and the qualitative data was used to support the quantitative data.

A deductive research approach was undertaken in the form of an empirical review of relevant literature to gain insight into the factors found in other research to add value to healthcare buildings, which was then incorporated into an Expert Sample survey to validate them; the results of the Expert Sample were subsequently used to develop and conduct the inductive study which was in the form of an Analytical Hierarchy Process weighted comparison survey of the factors identified and validated by the literature review and the Expert Sample survey.

3.5 Sampling

Sampling is the selected of a number of subjects from a specific population to represent that population. Methods of sampling can be probability sampling or non-probability sampling (Kremelberg, 2011). The sampling method used to choose to participate in a sample is determined based on the input needs for the research data.

3.5.1 Probability Sampling

In probability sampling data is collected from respondents who have equal chances of being selected (Kremelberg, 2011).

Kremelberg (2011) highlighted four main types of probability sampling: simple random, systematic, cluster and stratified sampling. These include:

- Simple random sampling. For this type of sampling all possible subsets of a are given an equal probability of being selected.
- Systematic Sampling: For this type of sampling, a random start is made and then every kth element from that point onwards is selected to be included, where k = N / n , where k is the ratio of sampling frame size N and the desired sample size n , and is formally called the sampling ratio.

- Cluster Sampling: For this type of sampling, the population is divided into “clusters” (usually based on geographic locations), then random samples are collected from the clusters, and the units within each cluster are measured.
- Stratified Sampling: For this type of sampling, the sampling frame is divided into homogeneous and non-overlapping subgroups (called “strata”), and a simple random sample is chosen from each subgroup.(Kremelberg, 2011).

3.5.2 Non-Probability Sampling

In non-probability sampling data is collected from respondents who do not have equal chances of being selected for participation.

Kremelberg (2011) highlighted four main types of non-probability sampling: incidental or accidental, expert, snowball and quota sampling. These include:

- Incidental/Accidental Sampling: For this type of sampling a sample is derived from a segment of the population that is close to hand, readily available, or convenient.
- Expert Sampling: For this type of sampling respondents are chosen in a non-random manner based on their expertise on the phenomenon being studied.
- Snowball Sampling: For this time of sampling, a few respondents are identified based on defined inclusion criteria and they are then asked to recommend others who also meet the defined inclusion criteria.
- Quota Sampling: In this type of sampling, which is similar to stratified sampling, the population is segmented into mutually-exclusive subgroups, and then a non-

random set of observations is chosen from each subgroup to meet a predefined quota (Kremelberg, 2011).

3.6 Expert Sample Survey

The Expert Sample (Appendix A) consisted of a mixed open and close ended survey that asked participants to give their expert opinion on whether or not the factors derived from the literature review added value to the healthcare building in Saudi Arabia and to gain insight into their perceptions of the various factors. Responses were analysed and combined, and then used to develop the second survey. According to Frey, in The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation (2018), “Expert sampling involves identifying key informants who can inform an inquiry through their knowledge, experience, and expertise”. An alternative method could have been the Delphi Approach, but the researcher did not feel that an added discussion of the results with the expert sample would add any further insight. The survey was distributed via email to professionals with at least 2 years work experience in a healthcare facility in Saudi Arabia. This included medical personnel and high level administrative staff whose activities, satisfaction and well-being at work can be directly affected by the factors. The required two-year work experience was based on the length of a standard employment contract for expatriates employed in the healthcare industry in the Kingdom to ensure that respondents had spent at least on contractual period and started a second. The data generated both quantitative and qualitative results. Quantitative results were manually calculated and reported as statistics, and the qualitative results were analyzed using NVivo Software. Mourshed, and Zhao (2012) suggest that staff opinions on the healthcare building design provide expertise and valuable input due to their familiarity with the physical environment and how it related to work requirements.

For the purpose of this study non-probability sampling of an expert sample consisting of 14 participants was used for the first instrument.

3.7 The Second Survey Instrument

3.7.1 Multi Criteria Decision Making (MCDM)

MCDM tools are used to facilitate complex multi criteria and multi alternative decision making. There are a number of different MCDM tools with a wide range of applications in diverse fields. The choice of tools depends on the specific input and output requirements of a particular decision problem (Saaty 2008). MCDM tools can be utilized to rank criteria and alternatives and determine criteria weights to evaluate performance. The technique for order of preference by similarity (TOPSIS) is one MCDM tool that has been applied to MCDM related to building design. The TOPSIS method determines the outcome which is closest to the ideal and the outcome which is farthest from the ideal solution, but it does not provide participant perceptions of the relative importance of these distances (Ogrodnik, 2019).

The Operational Competitiveness Rating Analysis (OCRA) is a relatively new tool for measuring performance that can also be used for MCDM, and which has been found to be particulary effective when there is a need to assign diverse weight distributions to different criteria (Parkan & Wu, 2000).

The Analytical Hierarchy Process (AHP) is a tool for MCDC that can be used to assess participants perceptions of the the priority or weights among the criteria and alternatives. AHP also provides a hierarchically structured perspective of the

qualitative and quantitative perceptions of participants (Harputlugil, Gültekin, & Topcu, 2009). While all three of these tools were considered, AHP was chosen for three reasons: its ability to determine the relative importance of criteria in comparison to alternatives; AHP has been used to determine user preference related to building design factors in previous studies; and it is a tested MCDM tool which has been applied and developed over decades.

Multi Criteria Decision Making (MCDM) methods were used in this research to determine multi-user weighted comparison of factors found to add value to the design of a healthcare building in Saudi Arabia. MCDM methods allow participants to make choices about preferences based on their individual perceptions.

3.7.2 Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) is a Multiple Criteria Decision Making (MCDC) method, developed by Saaty (1980) used to assess the priority or weights among the criteria and alternatives based on the comparative judgments of the chosen participants. AHP structures a decision problem into levels thus forming a hierarchy, where value is determined from the weighted sum of the qualitative and quantitative preferences of the stakeholders (Harputlugil, Gültekin, & Topcu, 2009). The AHP method 'supports an effective comparative analysis among the alternative projects based on determined criterion' (Harputlugil, 2018). The use of AHP for evaluation of architectural design

throughout the design process has been supported by several studies (Harputlugil, Gültekin, & Topcu, 2009; Harputlugil et al., 2014; Harputlugil, 2018).

The value of the AHP method lies in how it facilitates the combined evaluation of abstract and the concrete criteria, the performance of a consistency analysis, the ease with which the criteria and sub-criteria hierarchy can be defined, and the provision of clear and easily understood results are that enable decision making in complex situations (Harputlugil et al., 2014). However, when making all possible paired comparisons a redundancy in the information can occur which decreases consistency; however, this redundancy is of value in improving the validity of the outcome particularly when intangibles are involved.

The fundamental AHP scale of absolute numbers is has its roots in the psychophysical law of Weber–Fechner; the scale uses absolute numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, or word substitutes (Saaty, 2008). Paired criteria are compared using the scale to identify the lower weighted (less dominant) of the two criteria and then comparing its weighted score to the higher weighted score of the second criteria (dominant criteria). The reciprocal value is used for the comparison of the lower weighted criteria with the higher weighted one.

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order o

Figure 5 Saaty's Fundemental Scale of Absolute Numbers (2008)

The steps required in the formulation of an AHP framework consist of hierarchy construction, pairwise comparisons, deriving relative weights, consistency checking, and synthesizing results (Saaty and Vargas, 1991).

Step 1: Hierarchy Construction

The first step in AHP is the construction of the hierarchical structure. The elements a hierarchy level must be correlated with the other corresponding factors in the level. The formation of AHP hierarchy normally starts with the objective at the top level, and subdivides into lower-level decision factors. Typically is comprised of four levels: Level 1 states the objectives or goal, Level 2 consists of the main criteria, Level 3 is the sub-criteria, and Level 4 are the related alternative choices.

Step 2: Pairwise Comparison

In step 2, the relative importance of the main criteria and sub criteria is established through a pairwise comparison using a nine-point scale (see figure 2). Responses are

subjective, and establish a preference for one item over the other item on the same level of the hierarchy, and to assign a numerical value to quantify the judgment (Saaty and Vargas, 1991).

Step 3: Deriving Relative Weights

Step 3 comprises the estimation of relative weights for each of the criteria and sub-criteria of decision hierarchy. There are several approaches that can be used to derive the relative weights from the comparison matrix, of which eigenvector proposed by Saaty (1991) and logarithmic methods the most commonly applied.

The geometric mean is considered as the best choice for generating the eigenvector using the formula below.

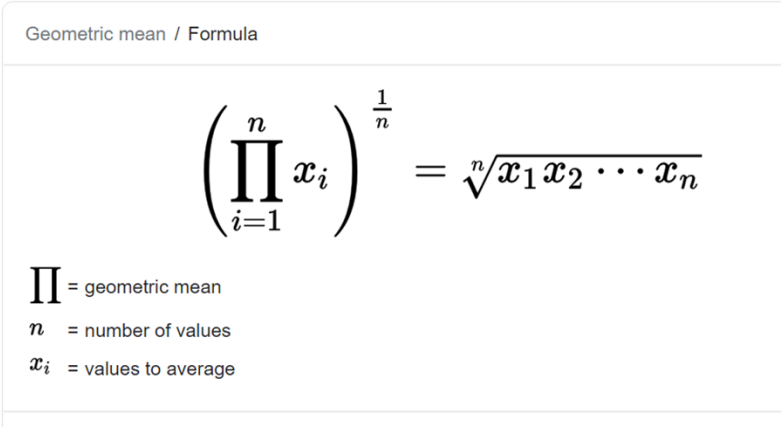


Figure 6 Formula for Geometric Mean

Then the total is derived and divided by the total outcome to determine the normalized roots (Saaty and Vargas, 1991).

Step 4: Checking the Consistency Ratio

Step 4 is to establish the validity of the consistency ratio. Consistency is an expression of the coherence that should exist between judgments about the elements of a set. A consistency ratio of the AHP paired comparisons can be used to validate the results. Saaty (1980) recommended a 0.10 consistency ratio; however, others have proposed that ratios between 0.098 and 0.102 can also serve to validate. Higher CR values suggest a need to revise the pairwise comparison, and/ or exclude answers and questionnaires for inconsistency if CR is greater than this boundary value (Saaty and Vargas, 1991). However, in the case of group input for the pairwise comparison, the threshold value can be raised to around 0.15 (Saaty, 1990).

Step 5: Synthesization of Results

In step 5 the relative values for each set of alternatives are calculated and combined to determine the overall score or criteria weight of each alternative.

3.7.3 AHP Questionnaire

The analytical hierarchy questionnaire consisted of 60 pairwise comparisons, 15 pairwise comparisons of the main criteria and 45 pairwise comparisons of the sub-criteria, each requiring weighted responses on the factors related to building design validated by the first survey instrument. The survey was distributed via WhatsApp and emailed to the chosen participants, who consisted of a previously contacted mix of architects, engineers, hospital administrators, patients and visitors with experience related to Saudi Healthcare facilities.

Applying AHP presented the priority weights of design alternatives for each factor; we then took two factors and compared them by plotting their priorities along the x and y axis using a two dimensional sensitivity diagram. A consistency ratio was determined using Cronbach's alpha to analyze the extent to which the respondents weighing of the factors and sub-factors reflected internal consistency.

3.7.4 The AHP Instrument Sample

Snowball Sampling of 20 participants from 4 specific user groups (medical staff, administrative staff, patients and visitors) was used for the second instrument. Individuals from each targeted group were asked to identify others within the same group and these individuals were approached and their participation requested.

3.8 Ethical approval

The 'Ethical Approval Form' was approved (Appendix I) before the research began and all ethical guidelines were followed. All participants were given a consent form (Appendix 2) and the participant information sheet (Appendix 3) to sign and were assured of the anonymity of their responses before participating in the research. All submitted surveys and derived data were stored on the researcher's personal computer and files were password protected. No contact details, including WhatsApp numbers or Email addresses were stored once the final submission of the survey instruments was made.

3.9 Limitations of the Study

A major limitation of this study was the impact of COVID 19. The first survey instrument was distributed in Saudi Arabia during full or partial lockdown, which made direct access to and follow up with respondents more difficult; it was originally intended for part of the first survey instrument to consist of face-to-face interviews, but due to social distancing and lockdown the questions and responses were in given form, which impacted the ability for the researcher to ask follow up or clarification questions . In addition, the relatively small number of participants for both instruments presents another limitation as it does not provide a wide scale of input. A third limitation lies in the fact that the respondents in both surveys worked and/or resided in one of the three major cities in Saudi Arabia which tend to have less conservative social norms than many of the less urban areas and may not reflect attitudes towards design factors held in more conservative parts of the Kingdom; this further enforces both the premise that culture and social norms affect value perceptions, and the need for studies conducted in sub-cultures within the Kingdom to identify universal and culturally specific factors.

3.10 Chapter Summary

This chapter outlined the philosophy, approach, procedure, strategy, and technique used to answer the research questions and achieve the research objective. This research is based on the deductive approach, in that the research focus has moved from general to specific based on the review of relevant literature and the generated data from the survey instruments.

Both qualitative and quantitative data collection and analysis methods (mixed-method research) were applied in this research.

The next chapter presents an analysis of data from the first instrument , the expert survey.

CHAPTER IV

EXPERT SURVEY DATA ANALYSIS AND RESULTS

Introduction to Chapter 4

This chapter presents the analysis of the data generated by the Expert Sample Survey. The following sections will discuss the data collected through the Expert Sample and their methods of analysis in detail. The final section of this chapter will discuss the findings and conclusions drawn from the data analysis. Expert Sample Instrument

The instrument comprised a survey questionnaire that consisted of both close and open ended questions related to the participants' opinions of the factors determined by the literature review to add value to healthcare buildings. All of the factors found in the secondary data collection literature review were included; factors related to the building design itself and factors related to other aspects of healthcare, such as cost of healthcare and staff care and attitude. In addition, although the expert sample instrument was distributed and completed via email (due to COVID 19 lockdown), affirmation of willingness to participate and of the participants 'expert' status were gained prior to emailing the instrument. In addition, the instrument and factors were explained to each participant in detail via a phone call prior to the participant giving his/her input to ensure complete understanding of what each factor encompassed.

4.1 The Sample

For this instrument the non-probability expert sampling was used. The sample size consisted of 14 participants chosen in a non-random manner based on their status of 'expert' on the phenomenon being studied due to their employment at a healthcare facility in Saudi Arabia in a professional capacity for at least two years prior to participation. Twenty seven experts were approached to participate, fifteen agreed to participate, and a total of fourteen completed the instrument. The sample size was limited due to the labor intensive nature of qualitative research and the purpose of the instrument which was mainly to validate the factors derived from the literature.

4.2 Analysis of the Survey Data

The sub-sections within this chapter present the analysis of the data from the Expert Survey. The first part covers the demographic profile data; the following section presents the quantitative data gathered from the survey and correlates it with the qualitative data from the results of the Nvivo analysis.

4.2.1 Demographic Data

The first and second questions on the Expert Sample survey were designed to validate the participants' status as an 'expert'. For the first question, 'Have you ever worked or do you now work at a hospital in Saudi Arabia in a professional capacity?' all of the participants responded with 'yes'.

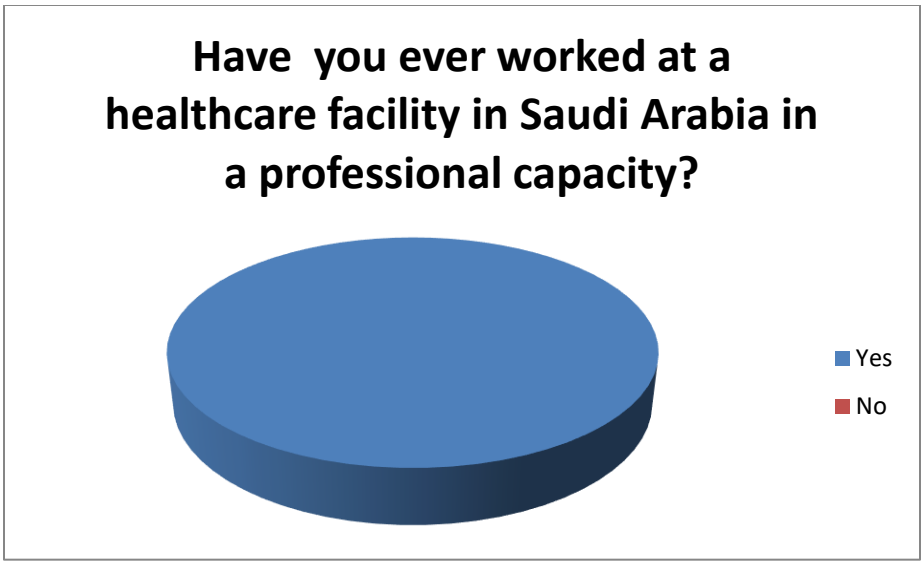


Figure 7 Status as Expert

Responses to the second question on the survey, which asked participants to 'Choose the option that best reflects your years of experience' show that 7 of the 14 participants had worked in a professional capacity at a Saudi healthcare facility for 2-5 years, 4 of the 14 participants had worked in a professional capacity at a Saudi healthcare facility for 6-10 years, and 1 of the 14 participants had worked in a professional capacity at a Saudi healthcare facility for 10 or more years.

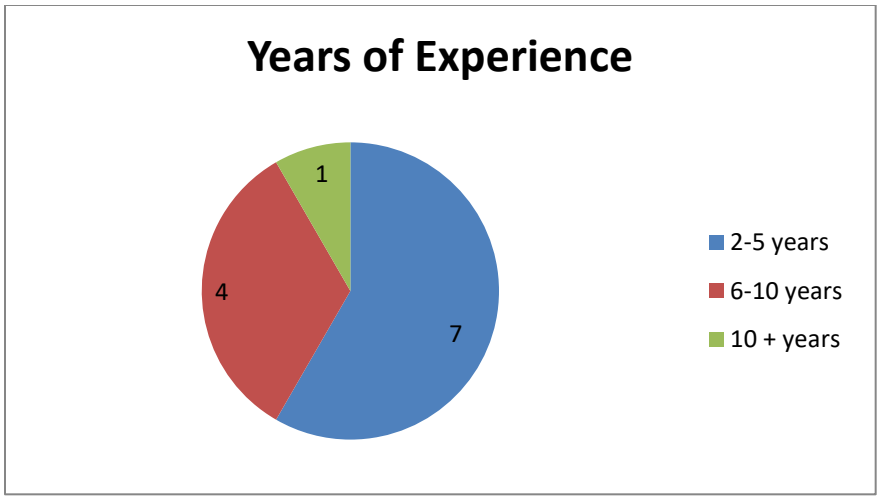


Figure 8 Years of Experience

As seen in the above charts, all of the participants included in the study fit the predetermined inclusion criteria for the Expert Sample.

4.2.2 Data Results

The expert sample participants were asked to rate the importance of the fourteen value drivers using a five point Likert scale with '1' signifying 'not important' and '5' signifying 'very important'. The results are outlined in the following figures:

Overall rating of the importance of the value drivers on a scale of 1-5

Factors	Rating Scale					
This value driver is:	Not important	Slightly important	Moderately Important	Important	Very Important	Average Rating
	1.	2.	3.	4.	5.	
1. Location/Accessibility				3	11	**4.79**
2. Building Design		1	2	6	5	**4.07**
3. Medical				1	13	**4.93**
4. Professional				1	13	**4.93**
5. Technical				5	9	**4.64**
6. Operational			1		13	**4.86**
7. Procedural				2	12	**4.86**
8. Economic			2	6	6	**4.29**
9. Policy				9	5	**4.36**
10. Patient's Room				7	7	**4.5**
11. Staff care and Attitude				4	10	**4.71**
12. Cultural		1	4	4	5	**3.99**
13. Spiritual		1	2	5	6	**4.14**
14. Risk and Safety				3	11	**4.79**

Table 3 Overall Rating of the Importance of Value Drivers on a Scale of 1-5

Average rating was determined by assigning the following values:

Rating	Assigned Value
Not Important	1
Slightly Important	2
Moderately Important	3
Important	4
Very Important	5

Table 4 Numerical Values Assigned to Ratings

The average values were determined by obtaining the arithmetic mean of the values assigned by the participants.

Factors in Descending Order of Value

Factor	Average	Rounded Average	Level of Importance
1. Medical	**4.93**	**5**	**Very Important**
2. Professional	**4.93**	**5**	**Very Important**
3. Operational	**4.86**	**5**	**Very Important**
4. Procedural	**4.86**	**5**	**Very Important**
5. Risk and Safety	**4.79**	**5**	**Very Important**
6. Location/Accessibility	**4.79**	**5**	**Very Important**
7. Staff care and Attitude	**4.71**	**5**	**Very Important**
8. Technical	**4.64**	**5**	**Very Important**
9. Patient's Room	**4.5**	**5**	**Very Important**

10. Policy	**4.36**	**4**	**Important**
11. Spiritual	**4.14**	**4**	**Important**
12. Economic	**4.29**	**4**	**Important**
13. Building Design	**4.07**	**4**	**Important**
14. Cultural	**3.99**	**4**	**Important**

Table 5 Factors in Descending Order of Value

The table above shows the descending order of the value rating of the importance of each of the fourteen factors generated by the expert survey sample. Results show that the factors with the highest average ratings are the Medical and Professional factors with an average rating of 4.93, followed by Operational and Procedural factors with a rating of 4.86. The factors with the lowest average ratings are Spiritual with a rating of 4.14, followed by Building Design with a rating of 4.07, and the factor with the lowest average rating is Cultural with 3.99.

The following charts display the data.

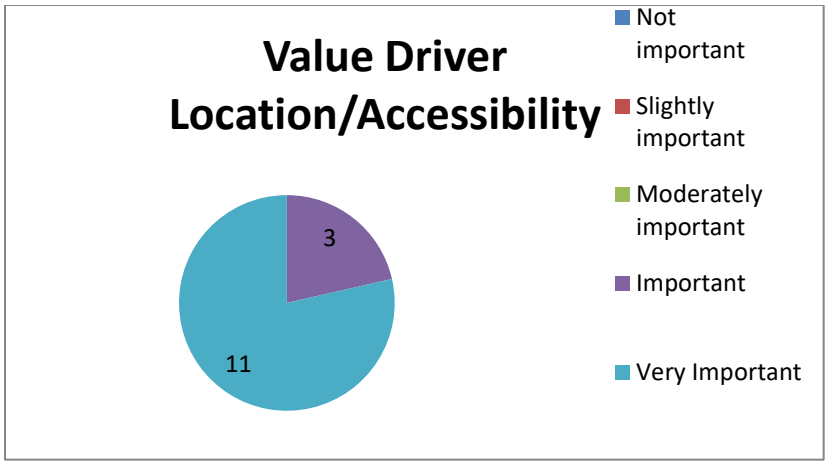


Figure 9 Importance Rating: Location and Accessibility

3 of the 14 experts said location and accessibility were important and 11 of the 14 thought it to be very important. This concurs with Ahmadi-Javid, Seyedi, & Syam (2017) proposal that a healthcare facility located so that it provides simple and quick access to all users adds value.

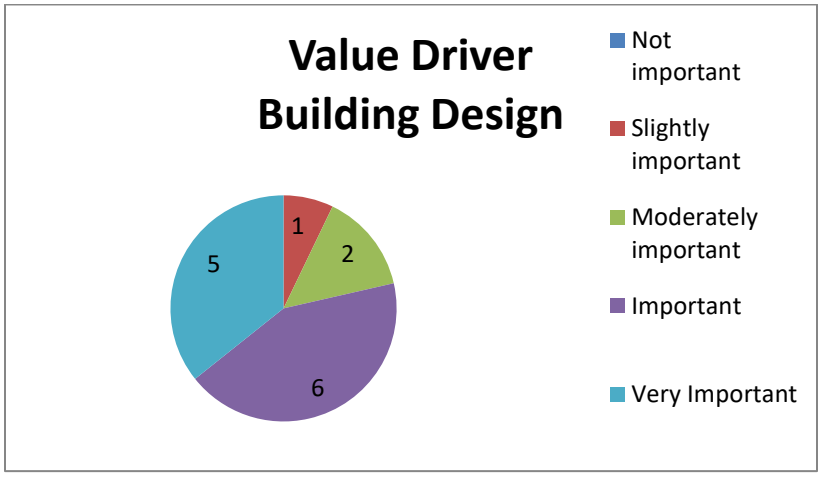


Figure 10 Importance Rating: Building Design

The results show that some of the experts (3) do not fully agree with the studies which propose that the design of the physical setting is of great value in healthcare buildings (Zimring & Ulrich, 2004; Mroczek et al.2005) with 1 of the 14 rating this factor as 'slightly important' and 2 of the 14 as 'moderately important'. The remaining 11 , however, rated it as either 'important' (5 of the 14) or 'very important' (6 of the 14).

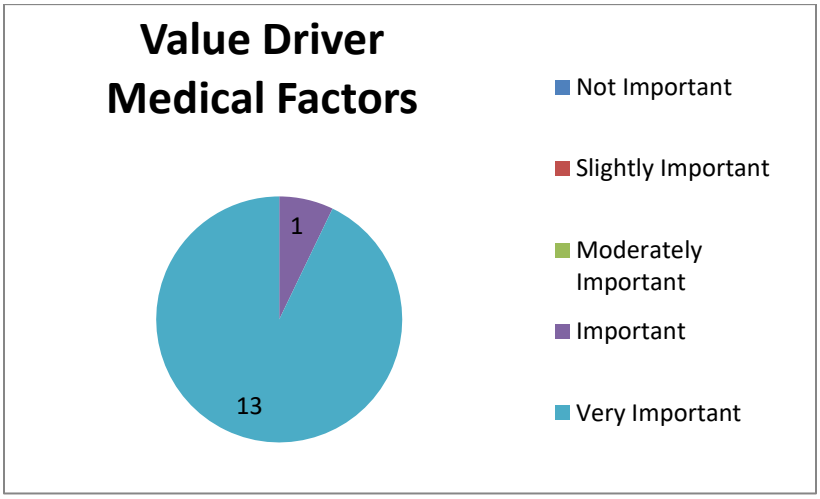


Figure 11 Importance Rating: Medical Factors

Medical factors were given one of the highest ratings by the expert participants with 1 participant giving a rating of 'important' and the remaining 13 giving a rating of 'very important'.

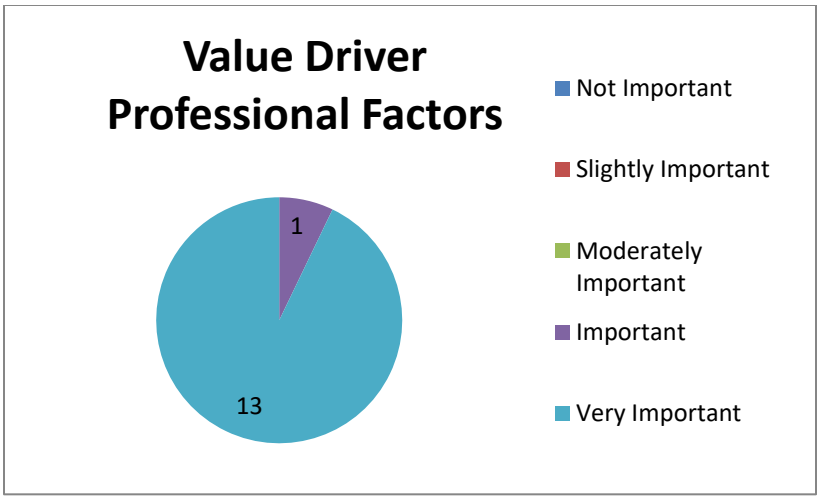


Figure 12 Importance Rating: Professional Factors

Professional factors received the same rating as medical factors with 1 of the 14 giving a rating of 'important' and the remaining 13 giving a rating of 'very important'.

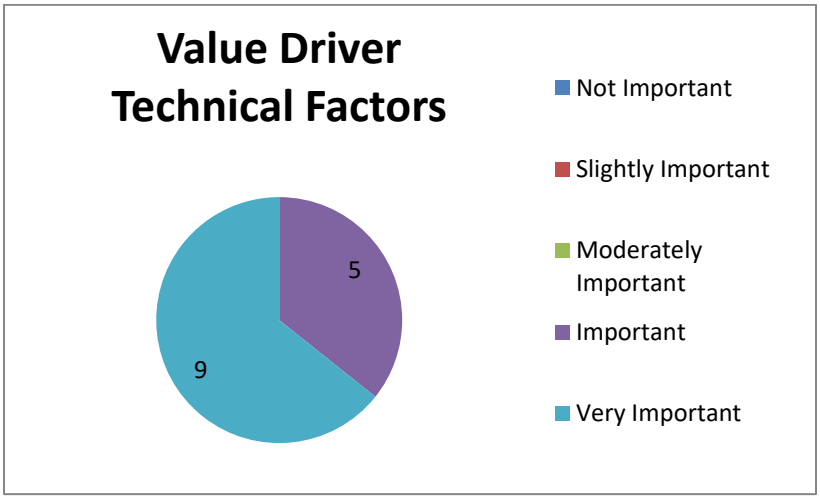


Figure 13 Importance Rating: Technical Factors

Technical factors, which were mostly related to the free and secure flow of information and continuity of service, were rated by 5 of the 14 rating it as important and 9 of them as 'very important'. This supports Hillary, et al's. (2016), findings that an electronic health records system to share information easily and efficiently between healthcare staff was of benefit.

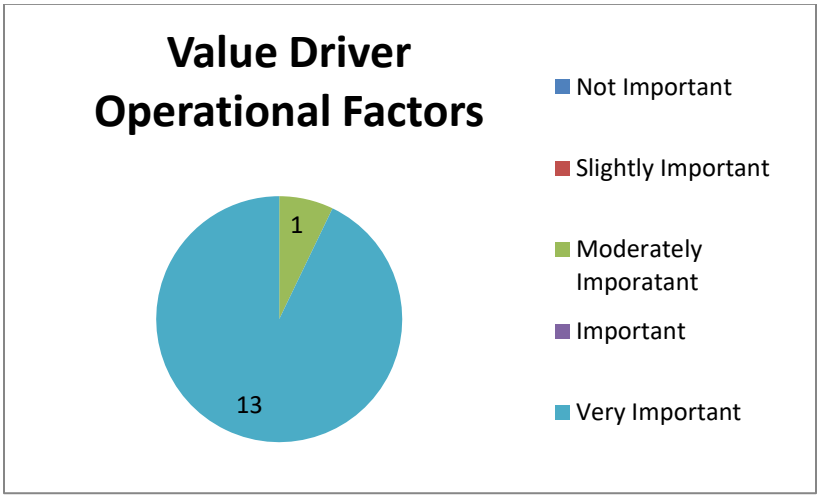


Figure 14 Importance Rating: Operational Factors

Operational factors were given also given a high ratings by the expert participants with 1 of the 14 giving a rating of 'important' and the remaining 13 giving a rating of 'very important'. Operational factors include logistics for the transportation of people and equipment and the supply chain.

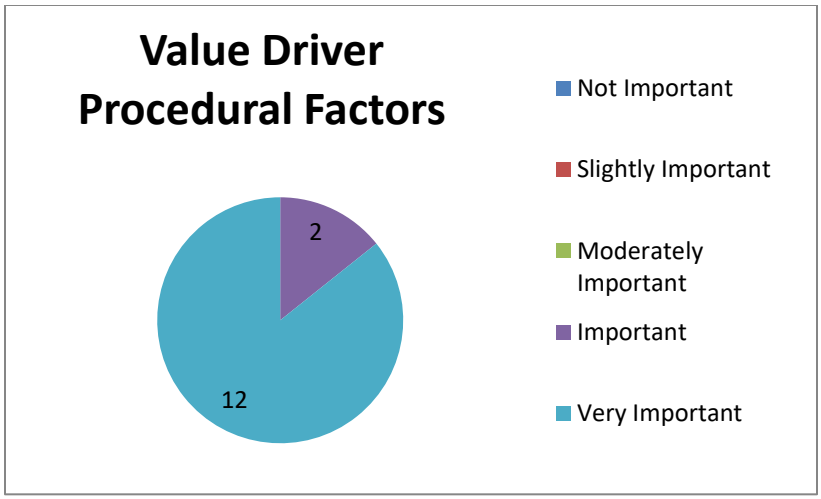


Figure 15 Importance Rating: Procedural Factors

Procedural factors were related to patients' rights to privacy and to service within a reasonable time frame. 2 of the 14 participants thought that the healthcare facilities procedural factors were 'important' while 12 were of the opinion that they were 'very important'.

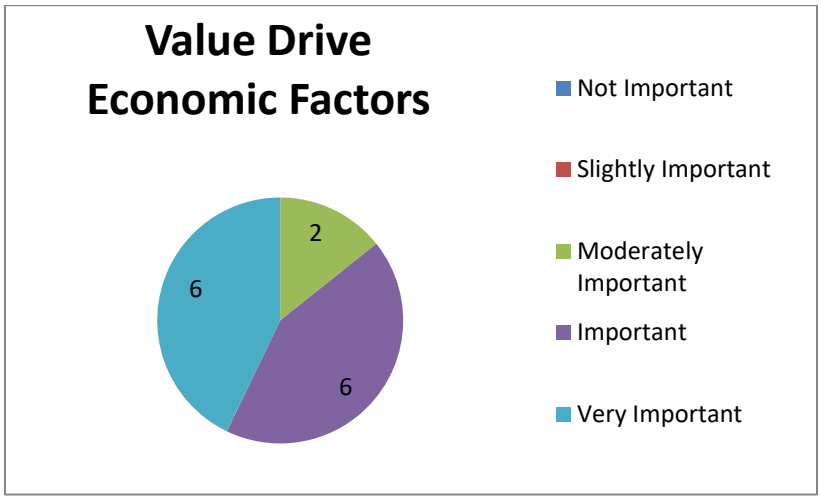


Figure 16 Importance Rating: Economic Factors

Economic factors were rated as ‘moderately important’ by 2 of the 14 participants, ‘important’ by 6 of the participants, and ‘very important’ by the remaining 6.

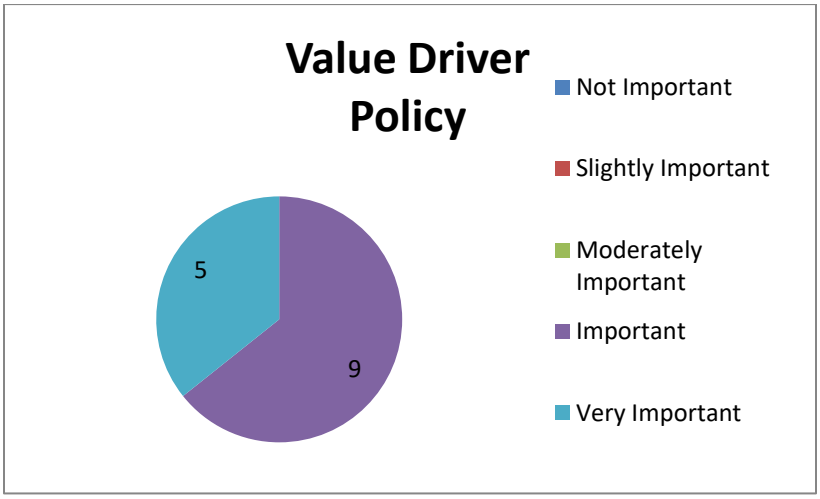


Figure 17 Importance Rating: Policy

Policy as a value driver in healthcare buildings was rated as ‘important’ by 9 of the 14 participants, and ‘very important’ by 5.

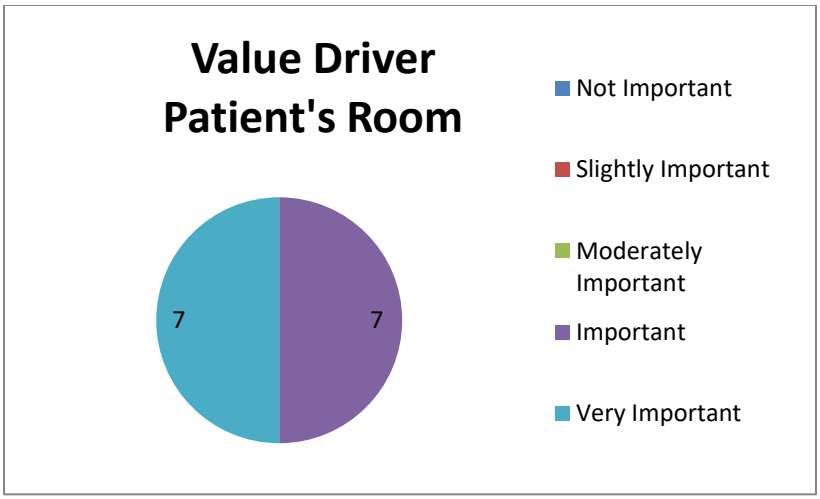


Figure 18 Importance Rating: Patient's Room

7 of the 14 participants rated the design factors of patient rooms as ‘important’ and the remaining 7 rated them as very important.

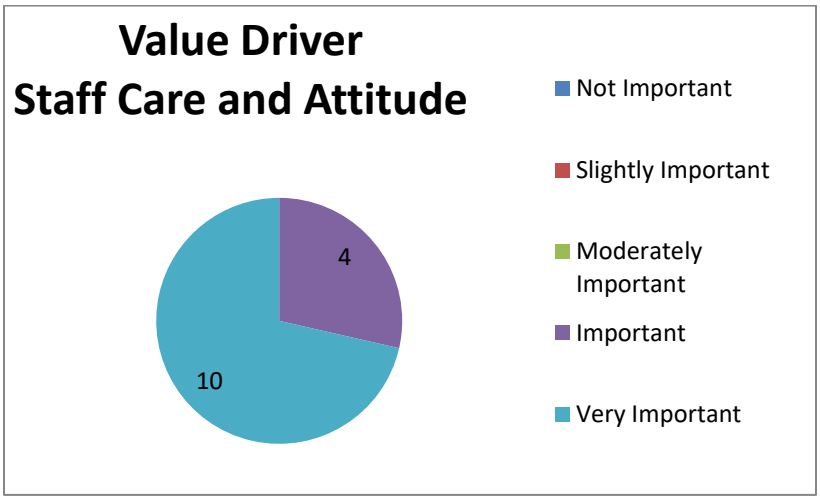


Figure 19 Importance Rating: Staff Care and Attitude

Staff care and attitude was rated ‘important’ by 4 of the 14 participants, and as ‘very important’ by the remaining 10 participants. Zimring & Ulrich (2004) and Mroczek et al.(

2005) noted that staff attitudes and level to which they are motivated to perform are directly related to their sense of well-being which is impacted by building design.

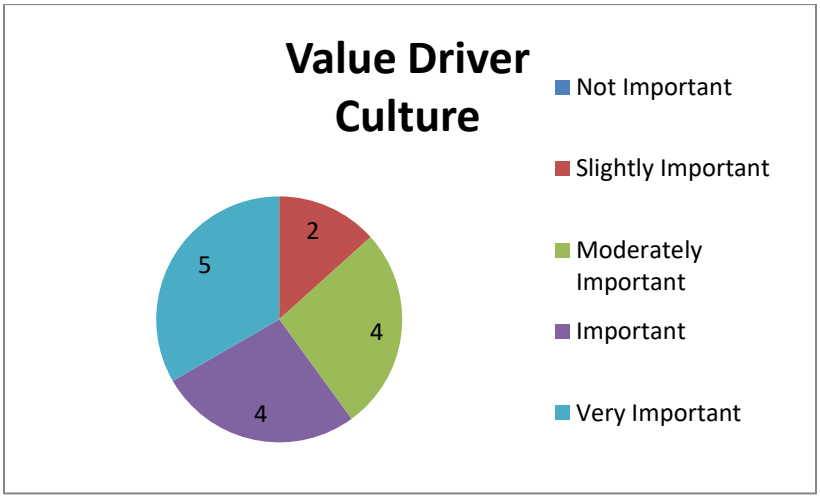


Figure 20 Importance Rating: Culture

Ratings for cultural factors were more mixed, with 2 of the 14 participants rating culture as 'slightly important', 4 as 'moderately important', another 4 as 'important' and finally the 5 remaining participants rated it as 'very important'. This suggests a lack of concurrence on the part of approximately half the respondents with Bromley's (2012) findings that hospital buildings need to reflect the unique attitudes, interests, concerns and values of the place and people they are located in (Bromley, 2012), and also with the recommendations of the UK Department of Health that 'In clinical and waiting areas, planning decisions should take account of patient culture and preferences in terms of privacy, modesty and same-sex accommodation.' (Health Building Note 00-01, pg. 23 section 5.26, 2014).

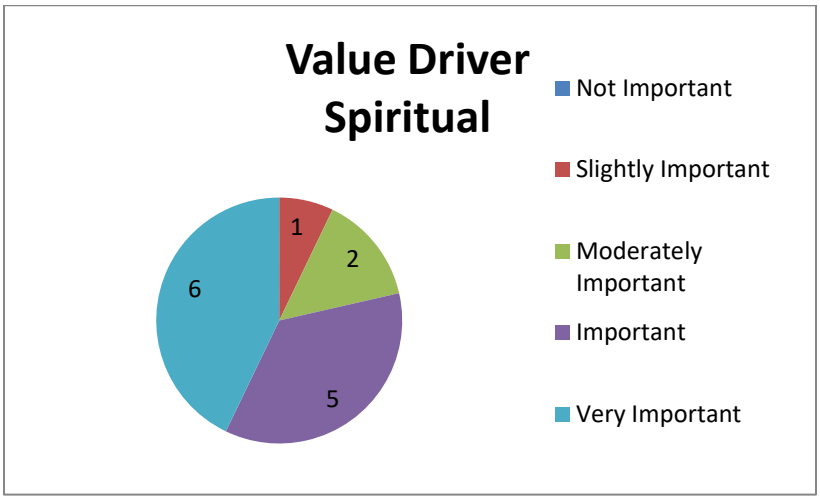


Figure 21 Importance Rating: Spiritual

Spiritual factors also received mixed ratings, with 1 or the 14 participants rating these factors as ‘slightly important’, 2 as ‘moderately important’, 5 as ‘important’, and 6 as ‘very important’. Thus, 11 of the participants concur with Cruz, ET al., (2018) findings that an environment which is conducive to spirituality improves patient, nurse and organizational outcomes.

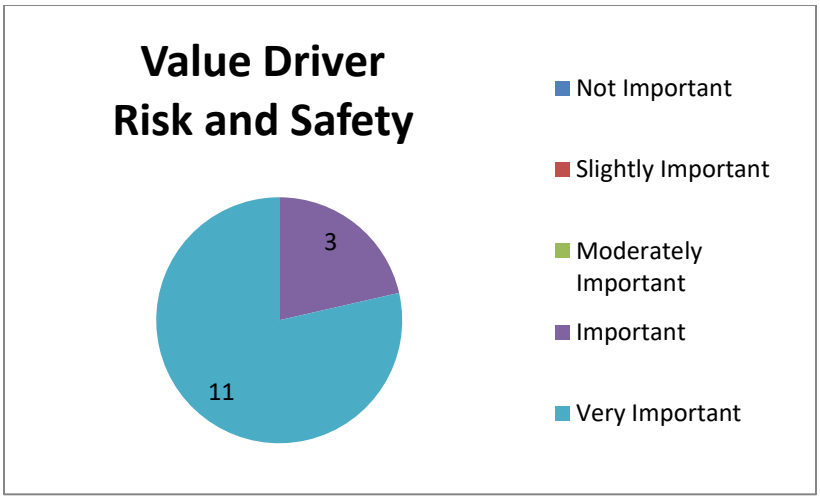


Figure 22 Importance Rating: Risk and Safety

Risk and Safety factors were rated as 'important' by 3 of the expert sample, and 'very important' by the remaining 11. These findings concur with studies that have noted the impact of building design features on risk and patient safety (Dickerman and Barach, 2008; Joseph & Rashid, 2008; Ulrich et al., 2008; Almutairi, 2015), and the need for a well-defined, standardized methodology to identify and eliminate built environment latent conditions that impact patient safety during the planning, design, and construction of healthcare facilities'.

In the following section there are charts showing the expert sample participants opinions on the value added by the sub-factors for each of the fourteen main factors. Average scores were determined by assigning 'Yes' a value of 1, and 'No' and 'NA' a value of 0. Values are rounded to the nearest hundredth.

These are followed by the results of the Nvivo thematic analysis of the same sub-factors and a combined discussion of the quantitative and qualitative results.

It should be noted that the expert sample consisted of individuals who had worked, or who currently work in a Saudi healthcare facility in a professional capacity, and that this is reflected in their perspectives.

Location and Accessibility

Value Driver	No	Selected Items	Adds Value	
Location/ Accessibility	1.	Close to major roads and thoroughfares	Yes 10	0.71
			No 4	
	2.	Ease of access through traffic flow	Yes 13	0.93
			No 1	
	3.	Sufficient parking	Yes 14	1.0
	4.	Proximity of available parking to building	Yes 12	0.86
			No 2	
	5.	Well marked signs signifying location	Yes 11	0.79
			No 3	
	6.	Clear and direct access to entry points	Yes 12	0.86

		No 2	
	7. Location of units with a high flow rates such as ER near an entrance to avoid unnecessary internal traffic flows	Yes 13 No 1	0.93
	8. Clear and close access to elevators from entrance	Yes 12 No 2	0.86
Are these items adequate to represent *location and accessibility*?	Yes 11 NA 3		0.79

Table 6 Added Value of Location and Accessibility Factors

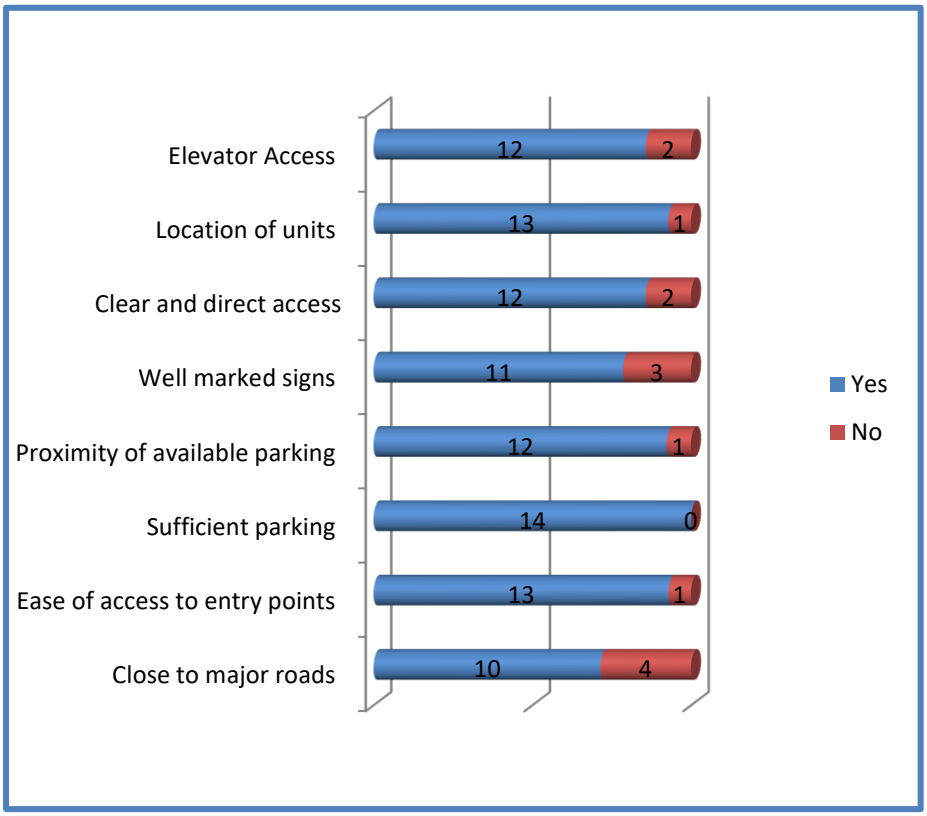


Figure 23 Location and Accessibility

Themes	Related to	Quotation	Sources	References
Ease of Access	Close to major roads and thoroughfares	*Location will be clear straightforward and easy to get to*	12	12
	Ease of access through traffic flow	*For easy access even during heavy traffic*		
	Well marked signs signifying location	*Allows smooth transportation to desired points*		
		To find easily in emergency		
	Locating units with a high flow rates near entrance	*Faster access when needed*		
		Yes, to avoid congestion		
		Ease of flow		
	Clear and close access to elevators from entrance	*Quick access to all aspects of institutions*		
		It's better only.		
		To stop crowding and people not knowing where to go		
		People will have a clear way		

		… to avoid congestion in other areas	6	6
Time Efficiency	Ease of access through traffic flow	*Prevent sick people from arriving late* *So that we can avoid waste of time while waiting the traffic.*		
	Sufficient parking	*Helps people get into their appointment/work on time* *To avoid time wasted looking for parking*		
	Well marked signs signifying location	*This saves time trying to find the hospital in an emergency* *Reduce search time*	6	6
Comfort and Well-Being	Clear and direct access to entry points	*Limits walking under unpleasant weather for long periods*		
	Proximity of available parking to building	*Reduce walking for patient* *For patient comfort* *Avoids complications of ER cases that need immediate*		

Ease of Identification of Entrance	Locating units with a high flow rates near entrance	*medical assistance* *This can save lives* *To arrive and be treated faster and not to have to walk far* *Especially to differentiate (sic) between visitor entrance (sic), ER and clinics* *Should be different from other areas which is available in my work place.* *…I think the internal traffic flow and accessibility is more important.* *Separate staff parking with ease of access* *Special road to ER* *For cancer care, it should be in a different building from the hospital and the ER. Meanwhile, there*	2	2
Internal Traffic Flow			1	1
Separate Staff Parking			1	1
Separate Access Route to ER			1	1
Separation of Cancer Care Units from Main Building in General Hospitals.			1	1

		has to be an access for patient to be transferred to ER or the hospital if needed.		

Table 7 Thematic Analysis Location and Accessibility

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

Ahmadi-Javid, Seyedi, & Syam (2017) propose that locating a healthcare facility so that it provides simple and quick access to all users, including those with urgent, secondary, tertiary and quaternary medical needs adds value. However, the results suggest that the experts considered sufficient parking, proximity of parking space to buildings, and ease of access to building entry points to be of greater value than having the facility located close to major roads, clear and direct access to the facility, and having well marked signs that facilitated locating and accessing the facility.

The themes that emerged from the Nvivo thematic analysis for the Location and Accessibility sub-factors were: 'Ease of Access' (12), 'Time Efficiency' (6), 'Comfort and Well-Being' (6), 'Ease of Identification of Entrance' (2), Internal Traffic Flow' (1), 'Separate Staff Parking' (1), Separate Access Route to ER' (1) and 'Separation of Cancer Care Units from Main Building in General Hospitals' (1).

The results from the Location and Accessibility section concur with those of other studies, including some conducted within the Saudi context. 13 od the 14 participants in the expert sample noted the value added by 'Ease of Access', with supporting comments such as

'Location will be clear straightforward and easy to get to', 'Allows smooth transportation to desired points', 'To find easily in emergency' and *'To stop crowding and people not knowing where to go'*. In should be noted that the participating experts were all professional medical staff and many comments noted the value of mobility and wayfinding in facilitating the execution of their duties.

Sufficient parking was seen to add value by 100% of the participants, supported by the comments: *'Helps people get into their appointment/work on time', 'To avoid time wasted looking for parking'* and finally proposing the need for *'Separate staff parking with ease of access'.*

In their Saudi based study on Person-Centered Care Design in Saudi Arabia, Ahmad, Singh, Kamal, and Shaikh (2020) propose clear and easy access to the building with sufficient parking close to entry point as a vital criteria in person-centered healthcare building design.

The value of 'Well marked signs signifying location' was affirmed by 79% of the expert sample. This suggest that while the majority of the participants concur with the findings of Devlin (2014), Rodrigues, Coelho, & Tavares, (2019) and Ahmad, Singh, Kamal, and Shaikh (2020) some of them do not concur that value is added by universal healthcare symbols to aid in healthcare facility navigation, particularly for users with cognitive and/or visual challenges and to aid with cross cultural issues.

Building Design

Value Driver	No	Selected Items	Adds Value	
Building Design	1.	Flow-through internal traffic design	Yes 10 No 4	0.71
	2.	Age of building	Yes 2 No 12	0.86
	3.	Aesthetic appeal of building design	Yes 9 No 5	0.64
	4.	High quality indoor climate, lighting and indoor air quality.	Yes 14	1.0
	5.	Ease of access and navigation to all areas of the building for the self-mobile and those who need mobility assistance.	Yes 14	1.0
	6.	Adaptable to allow for changes in layout, function and patient volume	Yes 9 No 5	0.64
	7.	Optimally facilitating medical care processes and supporting activities by spatial layout of top-clinical care areas.	Yes 11 No 3	0.79
	8.	Well considered location of operation theatres.	Yes 12 No 2	0.86
Are these items adequate to represent		Yes 11 NA 3		0.79

medical
factors?

Table 8 Added Value Building Design Factors

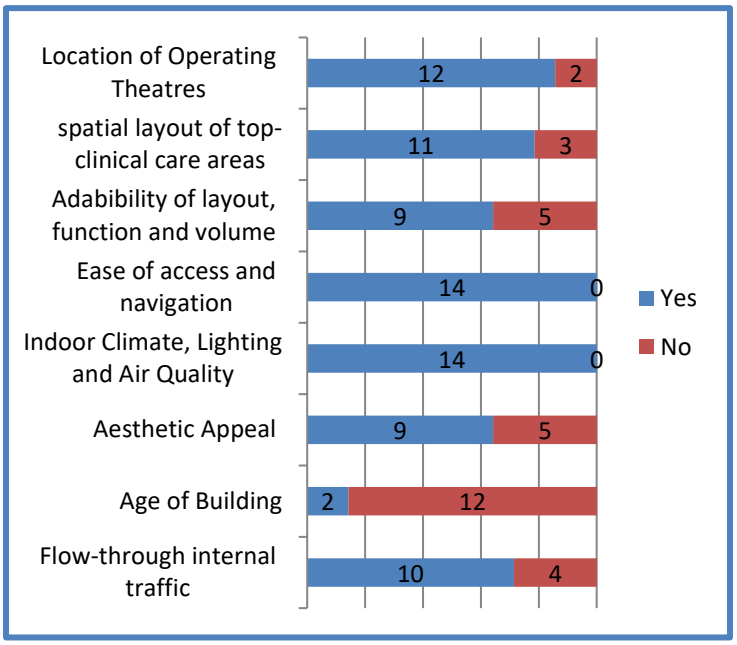


Figure 24 Building Design

Themes	Related to	Quotation	Sources	References
Access and Movement	Flow-through internal traffic design	*Reduces crowding* *Less crowding areas*	13	13
	Ease of access and navigation to all areas of the building for the self-mobile and those who need mobility assistance.	*Easy access for all* *Quick access to desired points* *This very important for moving patients* *Many patients need help to move around so this is important*		
	Location of operation theatres.	*Easier movement* *Fast and easy patient transport* *Needs to be short distance from all sections to ease heading to* *Near to ER.* *To move patients to OR back to room easily . Better if not in public way* *Moving patients on gurneys long distances is difficult*		
Maintenance		*To avoid transporting patients over long*	2	2

Health and Well-being	Age of building	*distances through the corridors* *It depends on how the building is maintained* *As long as the building is kept well and renovated as needed*	9	9
	Aesthetic appeal of building design	*Related to better patient outcomes* *Pleasing to the eye and mind* *This is important to staff and patient and patient family.* *Everyone is happier in a nice surroundings*		
	Quality of Indoor Lighting and Air	*Can affect patient recovery*		
Adaptability and Flexibility	Adaptability of Building Design	*Related to better patient outcomes* *Comforting and healthy for workers and patients* *For health and well-being* *Very important to health of users*	2	2

Function **Location of Specific Clinics**	Spatial layout of top-clinical care areas.	*Less future cost when change needed* *Important as the building ages to make sure it is in good condition and functions well* *To accommodate medical tools, staff and patients* *To function more efficiently* *Cancer treatment areas should be located in close proximity and have day patient areas that are family friendly.*	2 1	2 1

Table 9 Thematic Analysis Building Design

All of the participants agreed that Ease of Access and Navigation, and Indoor Climate, Lighting and Air Quality added value to the building design. Carr (2017) suggests minimizing travel distance between commonly visited spaces, locating support spaces so that they can be shared by adjacent functional areas, and grouping and combining areas with similar functional needs. 11 of the 14 expert participants agreed that the spatial layout of top clinical areas was of value; however, around 12 of the 14 agreed that the strategic location of operating theatres added value. 9 of the 14 proposed value added by the adaptability of layout, function and volume; thus not all of the participants agreed that building design must incorporate adaptability for it to be sustainable (Nedin, 2013; Støre-Valen et al., 2014). Dewulf and Wright (2009) found the need for the building design to provide flexibility and support for the core business activities during business

operations .The flow through of internal traffic was proposed to add value to the building design by 10 of the expert sample, which suggests that approximately one third of the participants do not concur with the value added by carefully designed internal access routes and points and navigation routes within a healthcare building proposed by Carr (2017); Devlin (2014) & Rodrigues, Coelho, & Tavares (2019). Aesthetics were seen to add value by 9 of the expert sample. Age of Building received the least positive responses with only 2 agreeing that it affected the value of the building design.

The themes which emerged from participants comments were 'Internal Access and Movement' (13) , 'Maintenance'(2) ,'Health and Well-Being' (9) , 'Cost efficiency' (2) , 'Function Efficiency' (2), and 'Location of Specific Clinics' (1).

Comments related to the value of aesthetic appeal and indoor climate, lighting and air quality all acknowledged understanding of how these factors affect user well-being and patient outcomes. These included: *'Related to better patient outcomes', 'Pleasing to the eye and mind', 'This is important to staff and patient and patient family'* and *'Comforting and healthy for workers and patients'.* Affirmation of value added and comments suggest participants concurrence with the proposal that the physical setting plays an important role in ensuring the well-being of the healthcare facility workforce (Zimring & Ulrich, 2004; Mroczek et al.2005) and improve patient outcomes (Zengul & O'Connor, 2013) .

Age of Building received the greatest number of 'no' responses as to whether it was an important factor for medical facilities or not. Only 2 of the respondents felt that it was a factor that added value. Value added by 'Age of Building' was commented on twice, and both times in relation to the need for maintenance: *'It depends on how the building is maintained',* and *'As long as the building is kept well and renovated as needed'*.

It should be noted that the maintaining of structures over the long-term is a general issue in Saudi Arabia.

Medical Factors

Value Driver	No	Selected Items	Adds Value	
Medical Facilities	1.	Availability of medicines/treatment.	Yes 14	1.0
	2.	Availability of modern medical	Yes 12	0.86
		equipment	No 2	
	3.	Well-equipped clinics	Yes 13	0.93
			No 1	
	4.	24/7 Emergency services	Yes 13	0.93
			No 1	
Are these items adequate to represent *medical factors*?		Yes 10		0.71
		No 1		
		NA 3		

Table 10 Added Value of Medical Factors

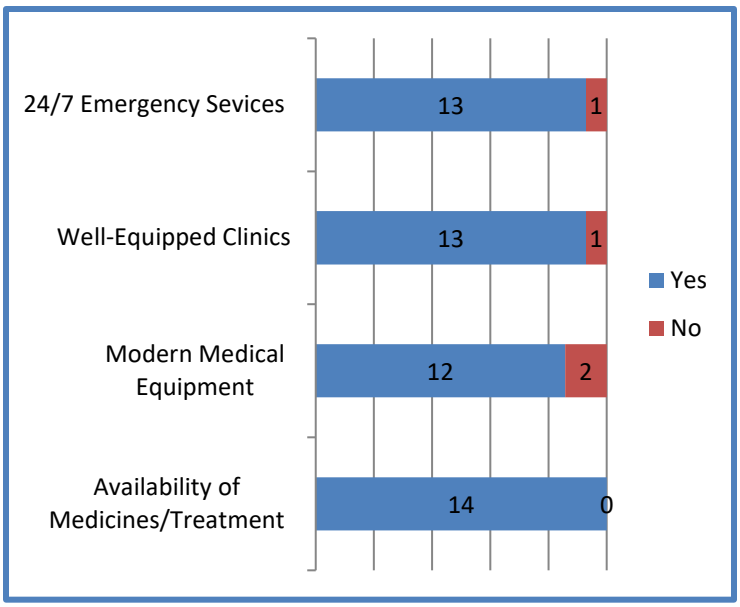


Figure 25 Medical Factors

Themes	Related to	Quotation	Sources	References
Improved Patient Care	Availability of medicines/treatment.	*It's the foundation of an institute*	6	6
	Availability of modern medical equipment	*More effort work and results*		
		To improve the quality of care.		
	Well-equipped clinics	*Ready for all basic and essential procedures*		
	24/7 Emergency services	*Help those in need around the clock*		

Single Patient Rooms		*Should be for patient care and safety.*	1	1
Home Delivery Services		*There should be more details about the single rooms availability, negative pressure, etc.* *Home delivery option for medications*	1	1
Availability of Clinics and Support Staff		*Assistants and clinics availability* *Availability of clinic space and support staff*	2 1	2 1
Speciality Clinics		*Cancer care requires outpatient clinics and day-care (works during the daytime) for chemo infusion. They will need inpatient floor which is not the main area for treatment and it can be a part of a hospital. The ER accessibility is important for everyone, but it doesn't need to be part of the*		

		clinic/day-care building.		

Table 11 Thematic Analysis Medical Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

All of the four sub-factors under Medical Factors were affirmed as adding value to a healthcare facility with 'Availability of Medicines and Treatment' receiving the highest number of 'Yes' given by all 14 of the participating expert sample , followed by '24/7 Emergency Services' and 'Well Equipped Clinics' at 13, and then by 'Modern Medical Equipment' receiving the fewest 'yes' responses with a total of 12.

The themes emerging from the comments were: 'Improved Patient Care' (6), 'Single Patient Rooms' (1), 'Home Delivery Services, (1)' 'Availability of Clinics and Support Staff'(2), and 'Specialty Clinics' (1).

Comments on the sub-factors were mainly related to the way in which the availability of medicines/treatment and modern medical equipment, well-equipped clinics and 24/7 emergency services could improve patient care (5). One respondent noted that the availability of medical facilities, supplies and equipment '...*is the foundation of an institute'* suggesting that this was the most important factor that added value to a healthcare facility.

Professional Factors

Value Driver	No	Selected Items	Adds Value	
Professional	1.	Qualified professional medical staff	Yes 14	1.0
	2.	Variety of specialists/consultants	Yes 13	0.93
			No 1	
	3.	Multi-disciplinary teams easily formed as needed	Yes 12	0.86
			No 2	
Are these items adequate to represent *professional factors*?			Yes 9	0.64
			NA 3	
			No 2	

Table 12 Added Value of Professional Factors

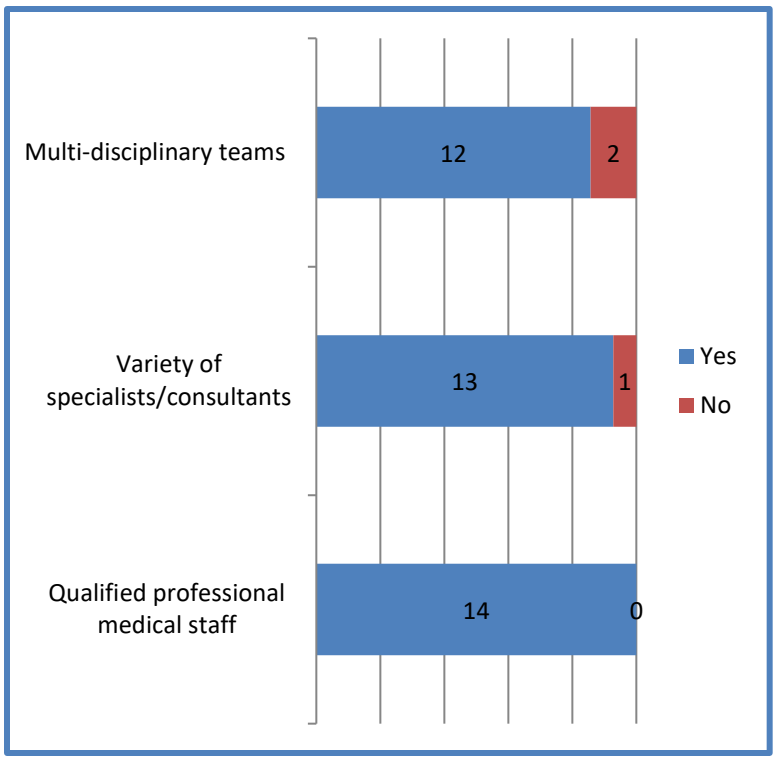


Figure 26 Professional Factors

Themes	Related to	Quotation	Sources	References
Efficiency and function	Qualified professional medical staff	*To work efficiently and make right decisions* *A very important factor in quality care* *To cover all faculty needs Better work strategies*	3	3
Need for Specialists and Consultants	Variety of specialists/consultants		5	5

Composition of Multi-disciplinary teams	Multi-disciplinary teams easily formed as needed	*To treat different cases* *To cover all medical issues* *Positive patient outcomes* *I would add the ability to call in external consultants when needed.* *The team should include members for patient support before, during and after in hospital treatment. This includes psychological support.*	2	2
Benefit of Multidisciplinary Teams		*The details are important for the multi-disciplinary team. This should state clearly the importance of social workers, psychologists, care coordinators, communication* *The use of multi-disciplinary teams allows for cross discipline treatment for patients will more than one*	1	1

		condition/disease mediators, etc.		

Table 13 Thematic Analysis of Professional Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

All three of the sub-factors under Professional Factors were reported as adding value by 12 of the participants. The availability of 'Qualified professional medical staff' was affirmed as adding value to the healthcare facility by all 14 participants; the 'Variety of specialists/consultants' received the next highest number of positive responses with 13, and the lowest number of positive responses was given to 'Multi-disciplinary teams easily formed as needed'. The later suggests that the value of the ability to quickly and efficiently form multidisciplinary teams within a hospital as proposed by Epstein (2014) is concurred with by the majority of the respondents.

Three major themes were extracted from the comments. These were: 'Efficiency and function' (3), 'Specialists and Consultants' (5) and 'Multi-disciplinary Teams' (3).

13 of the expert sample affirmed value added by qualified, professional medical staff, with the comments related to this sub-factor having the single theme of efficiency and function*: 'To work efficiently and make right decisions', 'A very important factor in quality care'* and *'To cover all faculty needs'.*

The value of multi-disciplinary teams was affirmed by 12 of the expert sample. Comments were added related to the composition of the multidisciplinary team: *'The team should include members for patient support before, during and after in hospital treatment. This includes psychological support'*, and *'The details are important for the multi-disciplinary team. This should state clearly the importance of social workers, psychologists, care coordinators, communication mediators, etc.'*

One participant commented on the benefit of multidisciplinary teams: '*The use of multi-disciplinary teams allows for cross discipline treatment for patients will more than one condition/disease'.*

Studies have shown that the ability to quickly and efficiently form multidisciplinary teams within a hospital can improve communication amongst healthcare workers, reduce risks, improve outcomes, decrease length of patient stay, and positively impact staff and patient satisfaction (Epstein,2014).

Technical Factors

Value Driver	No	Selected Items	Adds Value	
Technical	1.	Consistent connectivity to allow for information flow.	Yes 13 No 1	0.93
	2.	Clear process for and accuracy of internal information transfer.	Yes 14	1.0
	3.	Ease of place and time of independent access to (digital) data	Yes 9 No 5	0.64
	4.	Availability of digital appointment services.	Yes 12 No 2	0.86
Are these items adequate to represent *technical factors*?		Yes 11 NA 2 No 1		0.79

Table 14 Added Value of Technical Factors

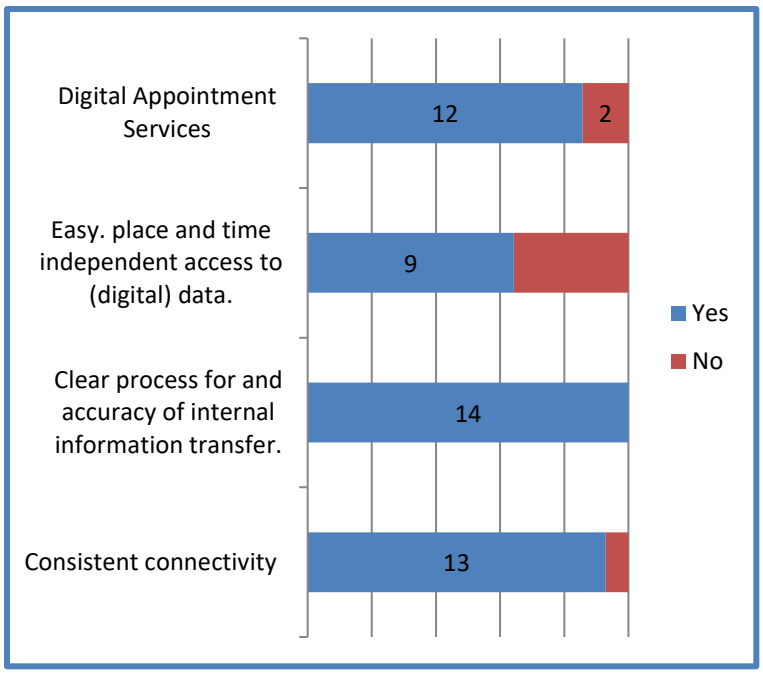


Figure 27 Technical Factors

Themes	Related to	Quotation	Sources	References
Storage of and access to information	Consistent connectivity to allow for information flow	*To be up to date with all information*	4	4
	Clear process for and accuracy of internal information transfer.	*Quick access to information* *For tracking and organizing of information*		
	Ease of place and time and independent access to (digital) data.	*To ensure continuous ability to exchange information digitally*		
		Results can be shared in real	3	3

Use of information in patient care	Consistent connectivity to allow for information flow.	*time and with everyone who needs access to them* *This is vital to ensure proper treatment and knowledge of medical history* *Quick notification of results to facilitate care*		
	Clear process for and accuracy of internal information transfer.			
Security	Ease of place and time and independent access to (digital) data.	*I think this needs to be restricted for security* *The system needs to be highly secure to protect information*	2 3	2 3
Time and Ease of Function	Availability of digital appointment services.	*Easy appointment reservation* *Easier* *Time saving and convenient*	2	2
24 Hour Operation of Services		*24/7 IT support* *24 hours available access to a coordinator or on call doctors.*		

Table 15 Thematic Analysis of Technical Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

The sub-factors under Technical Factors were related to IT infrastructure and ease of communication, based on the findings of Rechel, Buchan, and McKee (2009) who proposed that information and communication technologies are of increasing importance in healthcare service, and those of Bardach, Real & Bardach (2017) found that limitations in computer availability, documentation complexity, and sluggish sign-in processes formed barriers to effective and timely communication in a healthcare facility.

Three of the four sub-factors received affirmation as adding value to the healthcare facility . 'Clear process for and accuracy of internal information transfer' had the highest affirmation rate with 14 of the expert sample affirming it, followed by 'Consistent connectivity to allow for information flow' with 13 affirmations and 'Availability of digital appointment services' with 13 affirmations. 'Ease of place and time of independent access to (digital) data' was considered to add value by only 9 of the participants.

Five main themes emerged from the comments on the sub-factors related to technology: the 'Storage of and access to information' (4), the 'use of information in patient care' (3), 'security' (2) 'time and ease of function' (3) and '24 Hour Operation of Services' (2).

Comments on the first two themes related to technical factors were focused on the need for IT to support communication and promote optimal informed patient care. These included: *'To be up to date with all information', 'Quick access to information', 'For tracking and organizing of information', 'Results can be shared in real time and with everyone who needs access to them', 'This is vital to ensure proper treatment and knowledge of medical history'* and *'Quick notification of results to facilitate care'.*

Comments noted the need for security and to protect patient's right to privacy: *'I think this needs to be restricted for security'* and *'The system needs to be highly secure to protect information'*; when considered in conjunction with the need for information to be '…shared in real time and with everyone who needs access to them', this suggests a need for an infrastructure both within the IT system and within the building that is designed for both ease and speed of access to information and which also serves to fulfill security and privacy needs.

Operational Factors

Value Driver	No	Selected Items	Adds Value	
Operational Factors	1.	Clearly established operational plan for logistics and supplies	Yes 12 No 2	0.86
	2.	Well planned logistics for smooth transport of beds, bedclothes, food, medical facilities separate to patient traffic flows.	Yes 14	1.0
	3.	Well-considered distribution points.	Yes 9 No 5	0.64
	4.	Well developed and efficient inventory and ordering system.	Yes 14	1.0
Are these items adequate to represent *technical factors*?		Yes 12 NA 2		

Table 16 Added Value of Operational Factors

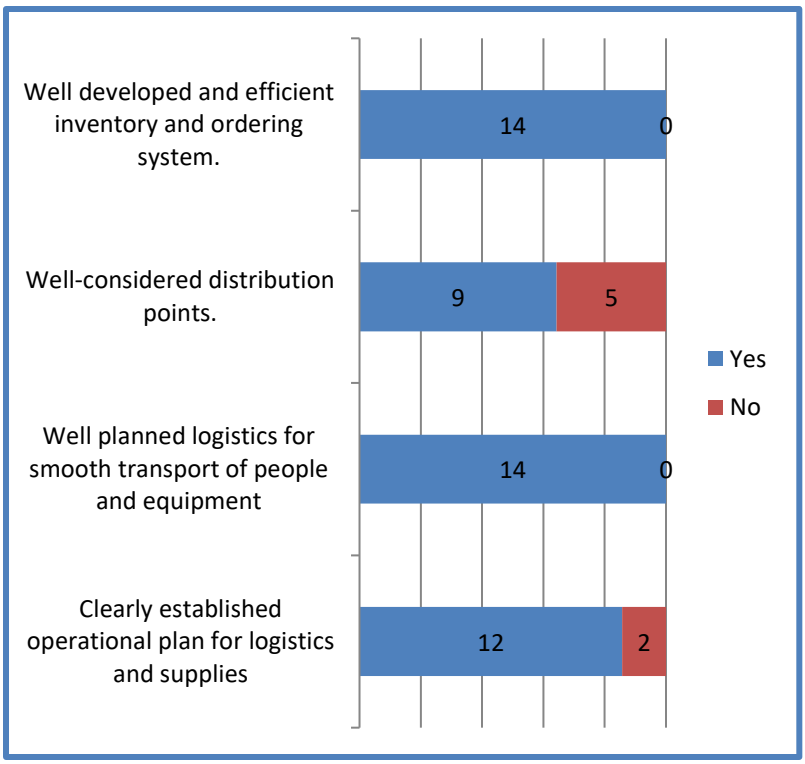


Figure 28 Operational Factors

Themes	Related to	Quotation	Sources	References
Organization	Clearly established operational plan for logistics and supplies	*A clear plan helps keep institute organized*	2	2
	Well developed and efficient inventory and ordering system	*Keeps place well organized*		
Access to and distribution of Supplies	Clearly established operational plan for logistics and supplies	*This is very important to continuity of supplies*	7	7
	Well planned logistics for			

Effect on individuals	transport of supplies Well-considered distribution points. Well developed and efficient inventory and ordering system. Well planned logistics for transport of supplies Well developed and efficient inventory and ordering system.	*To have what is needed in timely way* *For easy distribution* *So supplies are always available* *This is really important to avoid lack of essential things.* *The inventory and ordering system is vital* *Stock of materials (gloves, masks, etc.)* *In order to not interfere with patients way* *Prevent traffic and crowding*	2	2

Table 17 Thematic Analysis of Operational Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

The need for 'Well planned logistics for smooth transport of beds, bedclothes, food, medical facilities separate to patient traffic flows' was affirmed to add value by all 14 of the expert sample, as was a 'Well developed and efficient inventory and ordering system'

concurring with the findings of Carr (2017) that hospital facilities require an efficient logistics system, for the handling of wastes, supplies, laundry, food and recyclables. The need for a 'Clearly established operational plan for logistics and supplies' was affirmed to add value by 12 of the sample. The sub-factor receiving the lowest number of affirmative responses was 'Well-considered distribution points' with only 9 affirming its value.

Themes which emerged from the comments were: 'Organization' (2), 'Access to and distribution of Supplies' (7) , and 'Effect on Individuals'(2).

The benefit of operational logistics in organizing function was noted in comments such as: *'A clear plan helps keep institute organized'.* This supports the findings of Carr (2017) that hospital facilities require an efficient logistics system.

The need for Operational logistics in access to and distribution of supplies was supported by comments such as: *'So supplies are always available',* and *'This is really important to avoid lack of essential things'.*

The potential of Operational factors to effect individuals was noted in the comments that 'Well planned logistics for transport of supplies' were needed '*In order to not interfere with patients way'* and to *'Prevent traffic and crowding'.*

Procedural Factors

Value Driver	No	Selected Items	Adds Value	
Procedural Factors	1.	Ease and speed of appointment process.	Yes 13 No 1	0.93
	2.	Time to get an appointment.	Yes 10 No 4	0.71
	3.	Time and procedure for patient admission.	Yes 11 No 3	0.79
	4.	Protection of patient's right to privacy with respect to information sharing.	Yes 14	1.00
Are these items adequate to represent *technical factors*?		Yes 9 NA 3 No 2		

Table 18 Added Value of Procedural Factor

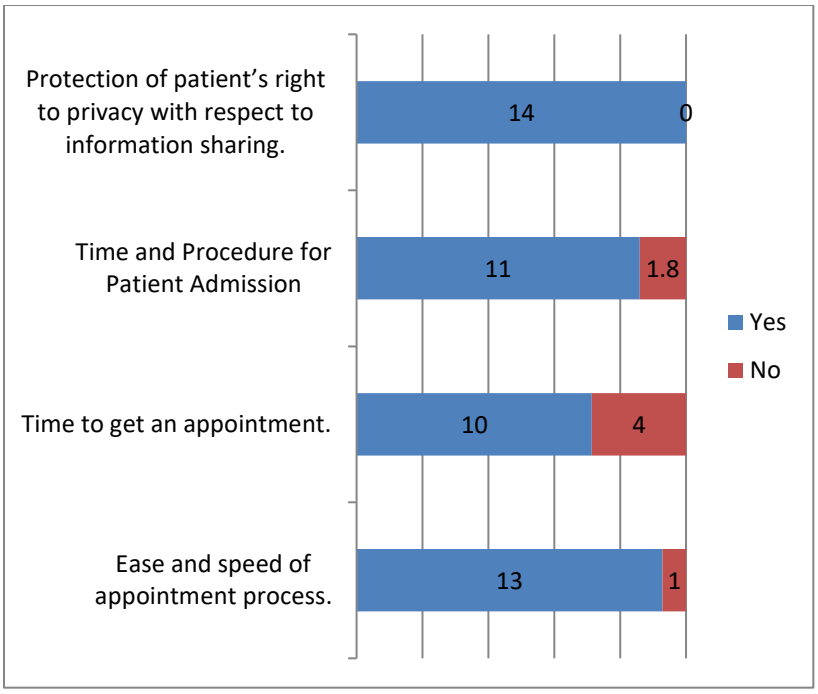


Figure 29 Procedural Factors

Themes	Related to	Quotation	Sources	References
Function efficiency	Ease and speed of appointment process.	*Less time waste* *For patients and doctors convenience* *Digital booking through apps* *Online booking* *Or booking through what's app number not only through call canter*	7	7

		Professional front desk to arrange the appointments and clinics Digital and online appointment *Digitalization of services through a platform like the one used for airline bookings*		
Speed of Service Delivery	Time and procedure for patient admission. Time to get an appointment.	*Patient may choose another hospital* *This depends on the medical issue and if the patient needs to be seen immediately or not.*	2 5	2 7
Patient's right to privacy	Protection of patient's right to privacy with respect to information sharing.	*This is the patient's right* *It's the patients legal right to have his info confidential* *This (patient privacy) is an issue here.* *There should be more regulation of patient information.* *Patient should sign who doctor*		

		can speak to about case and not just all family members asking questions.		

Table 19 Thematic Analysis of Procedural Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

The value added by the 'Protection of patient's right to privacy with respect to information sharing was universally affirmed. The value added by 'Ease and speed of appointment process' was affirmed by 13 of the sample participants. Interestingly, 'Time and procedure for patient admission' was affirmed to add value by 11 of the 14 and 'Time to get an appointment' was affirmed to add value by 10.

Themes which emerged under Procedural Factors were: 'Function efficiency' (7), 'Speed of Service Delivery' (2), and 'Patient's right to privacy' (5).

Facilitating the ease and speed of the appointment process was noted to increase function efficiency. Comments noted: *'Less time waste'* and '*for patients and doctors convenience'.*

Speed of service delivery in relation to patient admission procedure and time to get an appointed is noted as a factor in patient choice of hospital: '*Patient may choose another hospital'* . The comment related to time to get an appointment proposes: *'This depends on the medical issue and if the patient needs to be seen immediately or not'.*

Under the theme of patient's right to privacy, both the patients' rights and the need for regulation were commented on: '*It's the patients legal right to have his info confidential'* and *'There should be more regulation of patient information'*. One participant suggested that: '*Patient should sign who doctor can speak to about case and not just all family members asking questions'* and another noted: 'This (patient privacy) is an issue here'; both comments suggest that patients' right to privacy of information is an issue within the Saudi context.

Economic Factors

Value Driver	No	Selected Items	Adds Value	
Procedural Factors	1.	Resources available to maintain consistent flow of quality supplies and equipment	Yes 13 No 1	0.93
	2.	Resources available to ensure staffing needs are met.	Yes 14	1.0
	3.	Care/treatment cost.	Yes 13 No 1	
	4.	Partnership with medical insurance carriers.	Yes 14	1.0
Are these items adequate to represent *technical factors*?		Yes 10 NA 4		

Table 20 Added Value of Economic Factors

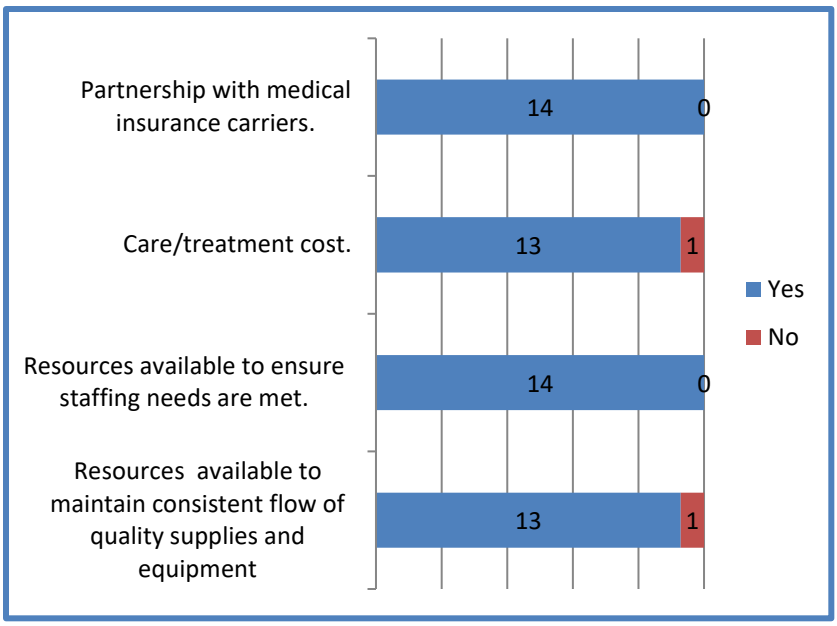


Figure 30 Economic Factors

Themes	Related to	Quotation	Sources	References
Function related	Resources available to maintain consistent flow of quality supplies and equipment	*Maintain consistent flow of supplies* *To function efficiently*	3	3
	Resources available to ensure staffing needs are met.	*To ensure staff needs are met*		
Cost related	Care/treatment cost.	*So patients arrange their budget to*	2	2

Patient Payment Method Related	Partnership with medical insurance carriers.	*treatment that is needed* *This is factor in patient choice of hospital* *Encourage all people from different economic level to go seek healthcare* *This is factor in patient choice of hospital* *Cash discounts* *Consider offering special packages or discounts for cash patients* *Discounts for cash payments and set up of payment schemes either prior to or post treatment.*	5	5

Table 21 Thematic Analysis of Economic Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

All of the Economic sub-factors received high affirmation levels. Both 'Resources available to ensure staffing needs are met' and 'Partnership with medical insurance carriers' were affirmed by all of the participants to add value to the healthcare facility, 'Resources available to maintain consistent flow of quality supplies and equipment' and

‘Care/treatment cost’ both received affirmation of adding value by 13 of the 14 participants in the expert survey sample.

Porter, (2009) notes the need in such cases for universal insurance coverage, which can be achieved by reforming and regulating the system.

The themes which emerged from the comments under Economic Factors, were: ‘Function related’(3) , ‘Cost related’(2) and ‘Patient Payment Method Related’(5).

Cost of care was noted as a *‘factor in patient choice of hospital’.* In relation to patient payment method, comments were related to two sub-themes: the value of health insurance and proposals to give cash discounts and make payment plans for those who pay cash. Medical insurance was proposed to *‘Encourage all people from different economic level to go seek healthcare’* Supporting Porter’s (2009) claim of the need for universal insurance coverage that makes quality healthcare available to all. Suggestions were also made for *‘Discounts for cash payments and set up of payment schemes either prior to or post treatment’.*

Policy Factors

Value Driver	No	Selected Items	Adds Value

Policy Factors	1.	Sufficient clinic opening hours and operating time.	Yes 13 No 1	0.93
	2.	Caretaker allowed to remain with patient 24/7	Yes 13 No 1	9.93
	3.	Regulations about patient bringing in decorative accessories for room.	Yes 10 No 4	0.71
	4.	Regulations about visitors bringing in food from external sources.	Yes 11 No 3	0.79
Are these items adequate to represent *technical factors*?		Yes 8 NA 3 No 2		

Table 22 Added Vlaue of Policy Factors

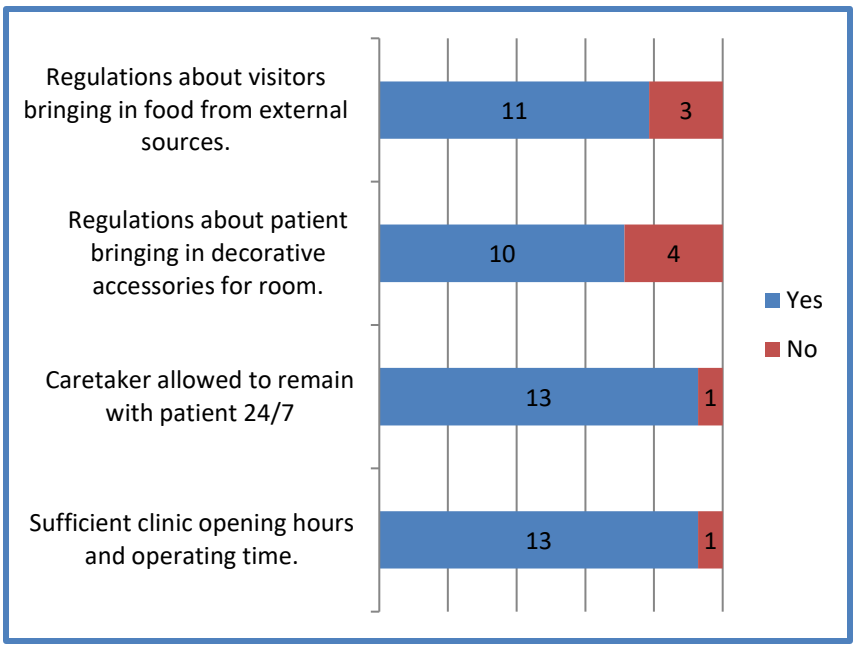


Figure 31 Policy Factors

Themes	Related to	Quotation	Sources	References
Related to comfort, quality control and efficiency	Sufficient clinic opening hours and operating time. Caretaker allowed to remain with patient 24/7	*To cover all times patients could need* *This helps the staff and the patient* *For patients support and care* *This reduce work on staff unless person is difficult* *Patients feel more comfortable when a family member is present*	7	7

Related to safety	Regulations about visitors bringing in food from external sources. Regulations about patient bringing in decorative accessories for room. Regulations about visitors bringing in food from external sources.	*Time frame for visiting hours* *Strict visiting policy that limits number of people who can be in patient's room and visiting hours* *To maintain certain quality of food in institute* *For patient and staff safety* *To protect the institute and patient from dangerous flammable material* *This is problem when small space and also for fire .* *Rooms need to be kept clear in case there is a problem* *Visitors often give patients who are on restricted diets food they should not have.* *Hospitals need to ensure that patients and families are aware off and*	7	7

Related to Treatment		*agree to comply with such regulations, and then enforce them with appropriate consequences.* *.* *Eligibility, inpatient treatment vs. outpatient treatment, admission criteria, clinical pathway for management.*	1	1

Table 23 Thematic Analysis of Policy Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

Policy sub-factors with the highest affirmation rating of adding value to the healthcare facility (affirmed by 13 of the 14 expert participants) included 'Sufficient clinic opening hours and operating time' and 'Caretaker allowed to remain with patient 24/7'. The latter concurs with the UK Department of Health's research findings that allowing relatives to remain with a patient and providing facilities to accommodate them can result in several benefits, including reductions in nurse-call button activity, and in patient falls (Health Building Note 00-01, pg. 36, 2014).

‘Regulations about visitors bringing in food from external sources’ was affirmed by 11 of the 14 and ‘Regulations about patient bring in decorative accessories for room’ was affirmed by 10.

Themes from the comments were: ‘Related to comfort, quality control and efficiency’ (7), ‘Related to safety’ (7), and ‘Related to Treatment’ (7).

Comments made under the sub-factor, ‘Caretaker allowed to remain with patient 24/7’ support the UK Department of Health, research findings that allowing relatives to remain with a patient and providing facilities to accommodate them can result in several benefits, including reductions in nurse-call button activity, and in patient falls (Health Building Note 00-01, pg. 36, 2014). Comments note the value of this to both patient and staff*: ‘This helps the staff and the patient’, ‘For patients support and care’, ‘This reduce (sic) work on staff unless person is difficult’,* and ‘*Patients feel more comfortable when a family member is present’*.

Facilities/ Patient's Rooms

Value Driver	No	Selected Items	Adds Value	
Policy Factors	1.	Size of room	Yes 13 No 1	0.93
	2.	Appearance of room	Yes 13 No 1	0.93
	3.	Sleeping facilities within patient's room for caretaker/companion.	Yes 14	1.0
	4.	Availability of 'suites'.	Yes 11 No 3	0.79
	5.	Sufficient available seating for guests.	Yes 12 No 2	0.86
Are these items adequate to represent *technical factors*?		Yes 9 NA 1 No 4		

Table 24Added Value of Facilities/ Patien's Rooms

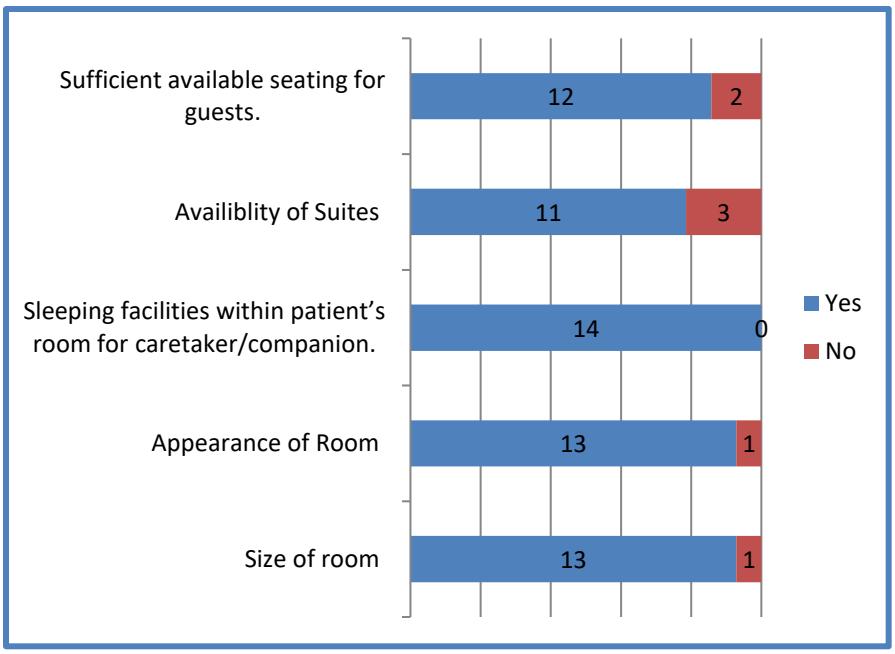


Figure 32 Facilities/ Patient's Rooms

Themes	Related to	Quotation	Sources	References
Related to room size/need for suites	Size of room	*Should be spacious enough for patient and caretaker*	6	6
	Availability of 'suites'.	*Patient prefer larger room* *May be important to some patients* *To suit patients that will stay for long period*		
	Appearance of room	*This (the need for suites) is true to attract the upper economic levels* *Availability of VIP Suites*	10	10
Related to room appearance and features		*Cold calm light colours* *Nice surroundings are part of the healing process*		

Need for sleeping facilities for companion	Sleeping facilities within patient's room for caretaker/companion	*Natural lighting and views* *Art* *Relaxing colours and comfortable furniture* *No, they also need to have sufficient on site equipment to save time in an emergency. I think this is really important from the patients perspective.* *Single rooms for all patients are better*	3	3
	Sufficient available seating for guests.	*Recliner seats* *Entertainment equipment* *The window views.* *For caretakers comfort and convenience* *This (sleeping facilities for visitors) very important in Saudi Arabia* *Should be spacious enough for patient and caretaker* *There is no need for a large number of visitors at one time.* *However, guests should be limited to a number that matches the number of seats* *For guest comfort* *Staff time can be wasted moving seats in and out of*	6	6

Need for sufficient visitor seating		*rooms, and also visitors sit on the patients bed and sometimes this is not good for the patient.* *Yes to avoid requests for additional seating which wastes staff time* *The number of visitors at one time should be limited to less than 6 to avoid overcrowding and making access of staff to patient difficult.*		

Table 25 Thematic Analysis of Facilities/ Patient's Rooms

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

For the sub-factors under Facilities/ Patient's Rooms 'Sleeping facilities within patient's room for caretaker/companion' was given the highest affirmation of adding value affirmed

by all 14 experts. This was followed by ‘Size of room’ and ‘Appearance of room’ with affirmation by 13 of the 14.’ Sufficient available seating for guests’ was affirmed by 12 of the 14 and the ‘Availability of suites’ was affirmed by 11 of the 14.

The themes which emerged from the expert sample comments on Facilities/ Patients’ Room were: ‘Related to room size/need for suites’ (6), ‘Related to room appearance and features’ (10), related to the ‘Need for sleeping facilities for companion’(3) , and related to the ‘Need for sufficient visitor seating’ (6) .

All of the expert sample agreed that ‘Sleeping facilities within patient’s room for caretaker/companion’ added value to the healthcare facility, concurring with the UK Department of Health, who propose that ‘Creating zones for patients, visitors and carers within the bed place helps each feel a greater sense of ownership and belonging’ (Health Building Note 00-01, pg.38, 2014). However, when the same sub-factor was rated under ‘Policy’ it received affirmation by only 13 of the 14 of the expert sample, presenting a discrepancy.

The an appealing appearance of the patient’s room was affirmed to add value by 13 of the expert sample with comments related to this including a need for: ‘*Natural lighting and views’, ‘Art’, ‘Relaxing colors and comfortable furniture’, ‘Recliner seats’, ‘Entertainment equipment’,* and *‘…window views’.* These results are supported by the UK Department of Health claims that there are increased positive patient outcomes when the design incorporates ‘natural light, elements of nature, soothing colours, meaningful

and varying stimuli, peaceful sounds, pleasant views and a sense of beauty' (Health Building Note 00-01, pg. 28, 2014), and those of Ahmad, Singh, Kamal, and Shaikh (2020) who suggest the provision of aesthetically appealing lighting conducive to a healing environment.

One participant noted the need for single patient rooms: *'Single rooms for all patients are better'*, and another proposed that a focus on aesthetics was not enough and that *'they also need to have sufficient on site equipment to save time in an emergency. I think this is really important from the patients (sic) perspective'.*

The presence of value added by sufficient available visitor seating in the patient's room was affirmed by 12 of the expert sample; however, some of the comments suggested a negative attitude toward a large number of guests (the Saudi norm) in the patients' room. Comments include: *'There is no need for a large number of visitors at one time'. 'However, guests should be limited to a number that matches the number of seats',* and *'The number of visitors at one time should be limited to less than 6 to avoid overcrowding and making access of staff to patient difficult'.* Other comments suggested that the seating should be provided to avoid the disturbance of staff: '*Staff time can be wasted moving seats in and out of rooms, and also visitors sit on the patients bed and sometimes this is not good for the patient'* and *'… to avoid requests for additional seating which wastes staff time'.* A single comment noted the benefit to visitors: *'For guest comfort'*.

Bromley (2012), proposes that healthcare buildings need to reflect the unique attitudes, interests, concerns and values of the place and people they are located in. This supports the finding that features of specific value to the Saudi culture, such the space and facilities for a caretaker/ companion to remain with the patient during his/her stay, and the need for sufficient space for a large number of visitors are of value (Ahmad, Singh , Kamal, and Shaikh, 2020).

Staff care and Attitude

Value Driver	No	Selected Items	Adds Value	Percentage
Staff Care and Attitude	1.	Staff shows care and concern	Yes 13 No 1	0.93
	2.	Staff consistently adheres to professional standards when interacting with patient.	Yes 14	1.0
	3.	Staff can communicate in Arabic.	Yes 14	1.0

	4.	Staff is consistently polite and respectful.	Yes 12 No 2	0.86
	5.	Staff responds to requests in a timely manner.	Yes 11 No 3	0.79
Are these items adequate to represent *staff care and attitude factors*?		Yes 11 NA 3		

Table 26 Added Value of Staff Care and Attitude

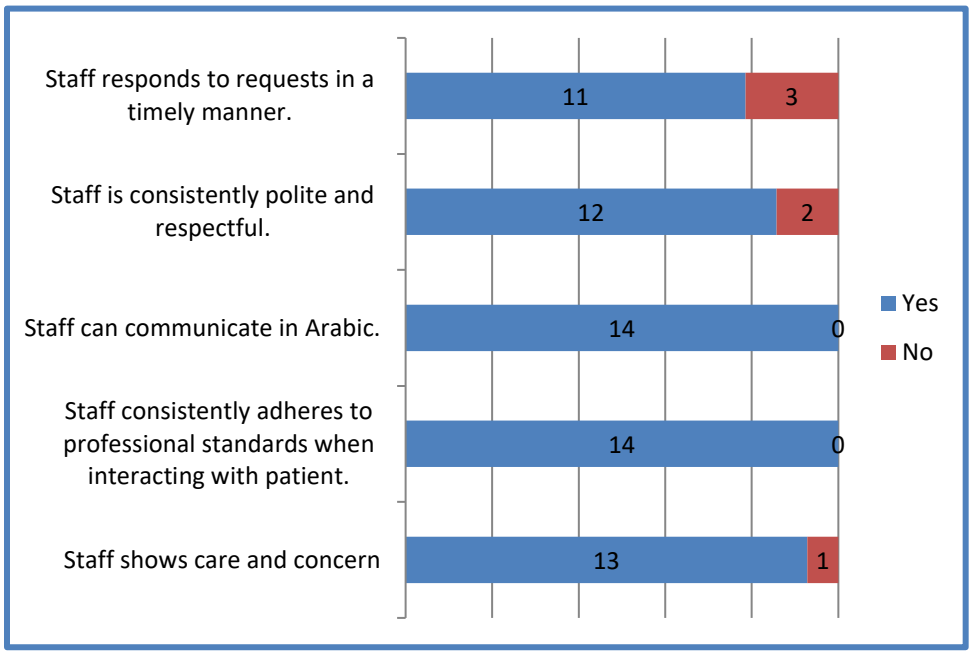


Figure 33 Staff Care and Attitude

Themes	Related to	Quotation	Sources	References

Staff/patient interaction	Staff shows care and concern Staff consistently adheres to professional standards when interacting with patient. Staff is consistently polite and respectful.	*Showing affection gives sense of security* *Patient comfort and experience* *Important part of being in a professional institution* *Important for staff to have high ethics and good manners* *This is a mutual need between staff, patient and visitors.* *Must be the case for staff, patient and patient family* *Staff should wear appropriate uniform and should look neat.* *Staff should always behave in a professional manner and keep calm, even when dealing with a difficult patient or visitor.* *Staff should dress and conduct themselves in a professional way always.*	9	9
Staff Ability to Communicate in Arabic	Staff can communicate in Arabic.	*Its essential that staff speak the*	4	4

Staff Response time to Patient Requests	Staff responds to requests in a timely manner.	*mother language of the country they work in* *They should be able to communicate with the patients.* *To understand each other* *Important for understanding of instructions and patient needs* *Depends on priority level of request* *Patients time is important* *This is important to the patient, but not always possible.* *Staff is often busy and cannot respond quickly. The important thing is that they do when it is necessary.*	4	4

Table 27 Thematic Analysis of Staff Care and Attitude

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

The sub-factors 'Staff consistently adheres to professional standards when interacting with patient' and 'Staff can communicate in Arabic' received universal affirmation as

adding value to a healthcare facility. ‘Staff shows care and concern’ was affirmed by 13 of the sample to add value, ‘Staff is consistently polite and respectful’ was affirmed by 12 of the 14 and ‘Staff responds to requests in a timely manner’ by 11 of the 14.

The themes which emerged from the comments related to Staff Care and Attitude were: related to ‘Staff/patient Interaction’ (9), ‘Staff Ability to Communicate in Arabic’ (4), and ‘Staff Response time to Patient Requests’ (4).

The IOM (Institute of Medicine) defines patient-centered care as: “Providing care that is respectful of, and responsive to, individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions” (pg 40, 2001).

The ability of staff to converse in the Arabic language was affirmed to add value by all 14 of the expert sample. Relevant comments, the majority of which were related to the need for clear communication between staff and patients, include: ‘*Its (sic) essential that staff speak the mother language of the country they work in’, ‘They should be able to communicate with the patients’, ‘To understand each other’* and *‘Important for understanding of instructions and patient needs’.* Results suggest that the participants agree with Almutairi (2015) who claims that non-Arabic speaking staff impede effective communication, and other studies which found that language differences between patient and caregivers can result in poor comprehension of and adherence to patient requests,

and lower quality of care, in addition to miscommunication which has been related to increased mistakes in medical treatment and procedures (Alshammari, Duff, & Guilhermino, 2019),

Comments suggest concurrence with Moore, et al. (2016), who found that patients valued staff who they perceived as courteous, attentive listeners, patient, caring, respectful, and understanding of their needs. Comments related to staff/patient interaction under 'staff shows care and concern' included: '*Showing affection gives sense of security',* that care and concern added to *'Patient comfort and experience'*. Other comments related to the need for professional behavior and appearance of staff noting that this was an '*Important part of being in a professional institution',* that it is *'Important for staff to have high ethics and good manners'*, that 'Staff should dress and conduct themselves in a professional way always', and *'Staff should always behave in a professional manner and keep calm, even when dealing with a difficult patient or visitor'*. Others noted that the need for polite respectful interaction was '…*a mutual need between staff, patient and visitors'* and that it *'Must be the case for staff, patient and patient family'.*

Cultural Factors

Value Driver	No	Selected Items	Adds Value	Percentage
Cultural Factors	1.	Staff can speak Arabic	Yes 14	1.0
	2.	Female/male staff assigned based on patient gender	Yes 10 No 4	0.71
	3.	Staff is culturally sensitive (eg. Covering female patients completely during transport)	Yes 11 No 3	0.79
Are these items adequate to represent technical factors?		Yes 9 No 1 NA 4		

Table 28Added Value of Cultural Factors

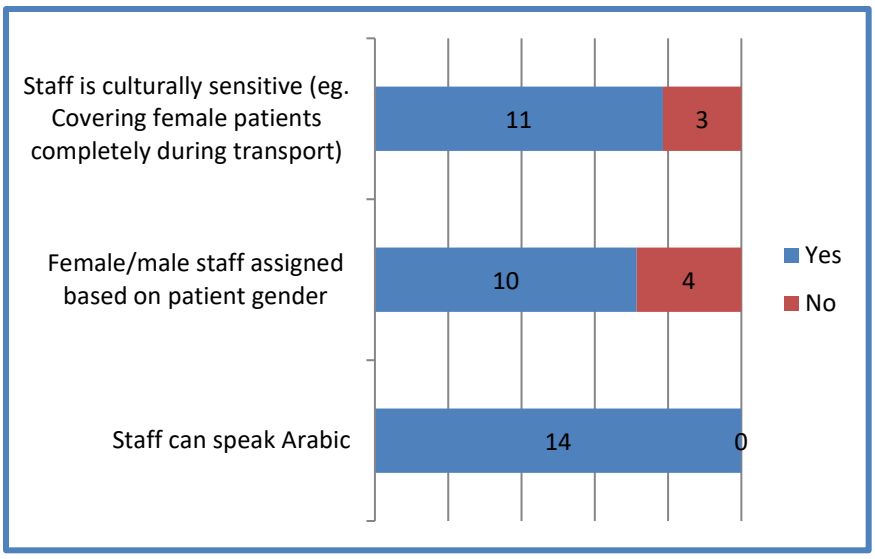


Figure 34 Cultural Factors

Themes	Related to	Quotation	Sources	References
Staff ability to communicate in Arabic	Staff can speak Arabic	*And English* *The staff need to be bilingual and speak Arabic and English* *They should speak both Arabic and English* *… but I think staff ability to speak English is also important.*	4	4
Staff adherence to gender norms	Female/male staff assigned based on patient gender	*For patient/staff comfort*	4	4

Staff awareness of cultural norms	Staff is culturally sensitive	*This is not as important as it was in the past.* *To be culturally appropriate* *This is only important if requested by the patient* *To be aware of cultural factors* *To understand patients concerns* *New staff from other countries should be given cultural lessons to help them deal with patients.* *Very important to staff patient/relations*	4	4

Table 29 Thematic Analysis of Cultural Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

The sub-factor 'Staff can speak Arabic' was affirmed as adding value by all of expert sample. 'Staff is culturally sensitive' was affirmed by 11 of the respondents; whereas 'Female/male staff assigned based on patient gender' was given an affirmation by 10 of the expert sample.

The themes which emerged from the Cultural factors were: ‘Staff ability to communicate in Arabic’ (4), ‘Staff adherence to gender norms’ (4), and ‘Staff awareness of cultural norms’(4).

One interesting point that emerged was that all four comments related to ‘Staff ability to communicate in Arabic’ noted the need for staff to also have English language skills.

The cultural factor received the lowest average rating of value added, with 3.99. Anåker, et. Al. (2016) proposed the value of considering the cultural norms of the geographical area in which the healthcare building is to be located.

The need for staff cultural sensitivity was given affirmation by 11 the expert sample, while the need for same patient gender assignation of staff was given affirmation by 10. This suggests that while a majority of the expert sample is aware of the value added by cultural sensitivity, and adherence to local cultural norms, some are not. For example, the UK Department of Health notes that ‘in some cases men and women should be segregated’ for patient privacy and dignity, and propose that this can be accomplished ‘operationally, by providing separate facilities or by designing for flexibility’ (Health Building Note 00-01 pg. 23 section 5.26, 2014),). Studies within the Saudi context have found a need within the Saudi culture to accommodate for individual’s privacy needs in a culturally appropriate way that provides for the dignity and modesty of staff and patients, (Ahmad, Singh, Kamal,

and Shaikh, 2020) and for sensitivity to and awareness of cultural and religious differences (Alshammari, Duff, & Guilhermino, 2019).

Spiritual Factors

Value Driver	No	Selected Items	Adds Value	Percentage
Spiritual Factors	1.	Mosque or prayer room onsite.	Yes 12 No 2	0.86
	2.	Qibla (direction of Kaaba in Mecca) clearly marked.	Yes 14	1.0
	3.	Internal and external 'sanctuary' spaces	Yes 13 No 1	0.93
Are these items adequate to represent technical factors?		Yes 10 No 1 NA 3		

Table 30 Added Value of Spiritual Factors

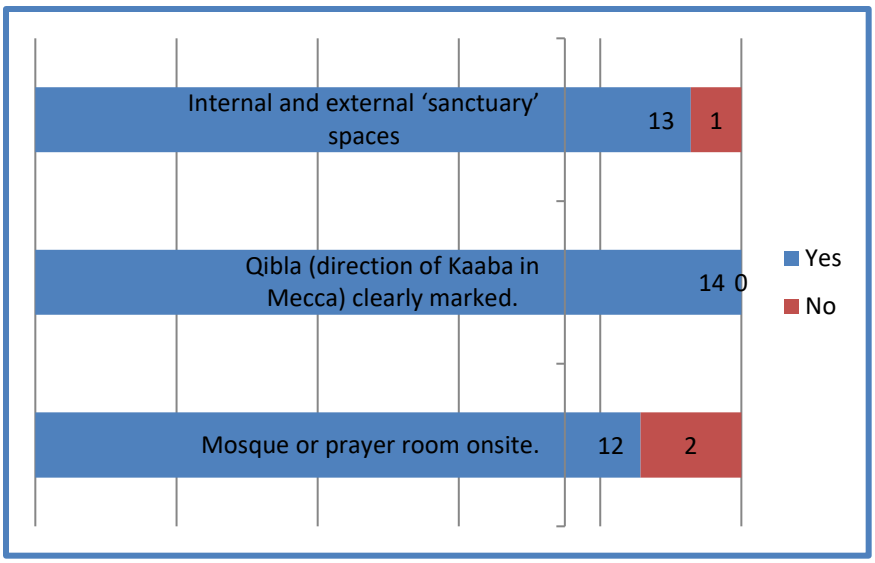


Figure 35 Spiritual Factors

Themes	Related to	Quotation	Sources	References
Locating and accessing Spiritual Spaces	Mosque or prayer room onsite.	*Easy access for patients and all institute workers* *There should be clear signs leading to it.*	3	3
	Qibla (direction of Kaaba in Mecca) clearly marked.	*Prevents wasting staff time asking about it all the time*		
Benefits	Internal and external	*Quiet areas are important*	4	4

Need for Natural Settings	'sanctuary' spaces	*For peoples convenience* *Of benefit to staff and patient well-being* *Staff, visitors, family and patients can benefit from places to relax.* *Natural Settings* *Garden would be nice for relaxation*	2	2

Table 31 Thematic Analysis of Spiritual Factors

The presence of internal and external spiritual places was affirmed to add value by 13 of the expert sample, and the value added by clearly marked Qibla direction was affirmed by 12 of the 14. This suggests agreement on the part of the experts that healthcare buildings need to reflect the unique attitudes, interests, concerns and values of the place and people they are located in (Bromley, 2012).

All 14 of the participants agreed on the value of having the direction of the qibla (the direction Muslims face for the five daily prayers) clearly marked in patient rooms for the patient and visitors.

The comments on the Spiritual factors were related to three main themes. These were:

'Locating and accessing Spiritual Spaces' (3), 'Benefits' (4), and 'Need for Natural Settings' (2).

13 of the 14 of the participants affirmed that the presence of internal and external sanctuary places, such as gardens, added value to the healthcare facility. This concurs with the findings of other studies which have found that patients with the natural scenery views had shorter hospital stays, very given more positive evaluations by nursing staff, took less medication and had slightly fewer post-operative complications (Ulrich, R. S. , 1984; Huisman, Morales, van Hoof, & Kort. 2012) and with that of who Ahmad, Singh, Kamal, and Shaikh (2020) proposed a seven criteria design framework for healthcare facilities in Saudi Arabia which included the need to provide areas with natural scenery such as indoor/outdoor or roof gardens for the use of patients and staff. Comments noted the value as universal to all users: *'Quiet areas are important', 'Of benefit to staff and patient well-being'* and *'Staff, visitors, family and patients can benefit from places to relax'*.

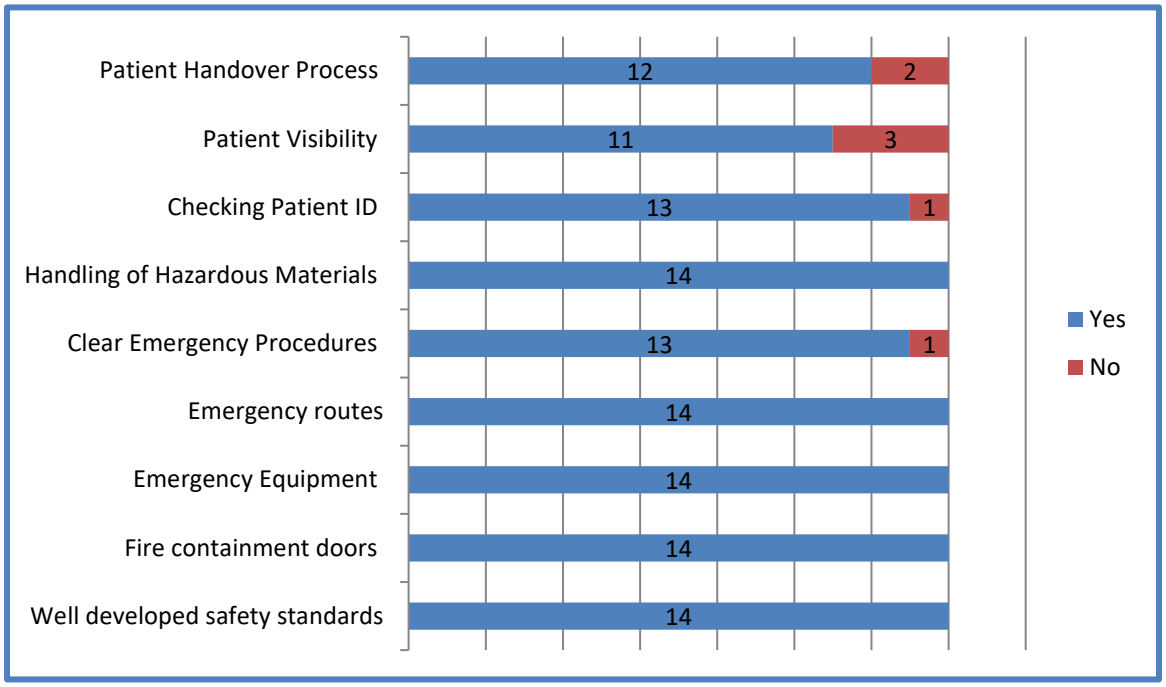
While all 14 of the participants affirmed the value added by clearly marked signage showing the direction for the Muslim prayer (the qibla) the single comment related to this noted the benefit to the staff rather than a psychological benefit to the patient perspective, with *'Prevents wasting staff time asking about it all the time'*.

Risk and Safety Standards

Value Driver	No	Selected Items	Adds Value	Percentage
Risk and Safety Factors	1.	Well-developed safety standards	Yes 14	1.0
	2.	Fire/containment doors	Yes 14	1.0
	3.	Emergency equipment readily available and accessible and regularly maintained.	Yes 14	1.0
	4.	Emergency routes/exits clearly established and marked.	Yes 14	1.0
	5.	Clear and visible procedures for emergency situations established	Yes 13 No 1	0.93
	6.	Hazardous materials appropriately handled within an established system	Yes 14	1.0
	7.	Clear and consistently checked patient identification	Yes 13 No 1	0.93
	8.	Clear and consistent patient visibility	Yes 11 No 3	0.79
	9.	Patient handover is minimized and consists of a comprehensive review of patient's	Yes 12 No 2	0.86

	condition and care needs at handover.
Are these items adequate to represent technical factors?	Yes 10 No 2 NA 2

Table 32 Value Added by Risk and Safety Standard Factors



Themes	Related to	Quotation	Sources	References
General Safety	Well-developed safety standards	*.Maintain safe environment*	7	7
		This is one of the most important things in the hospital.		
	Fire/containment doors	*In case of fire*		
	Emergency equipment readily available and accessible and regularly maintained.	*Easy access*		
	Emergency routes/exits clearly established and marked.	*To prevent peoples panic*		
	Hazardous materials appropriately handled within an established system	*Sharp needle containers*		
		Hazardous materials containers should be present in convenient locations.		
Patient Safety	Clear and consistently checked patient identification	*This should be standard procedure*	5	5
		This reduces the risk of medical errors		

Need for Oversight	Clear and consistent patient visibility Patient handover minimized and comprehensive.	*This is very important in units for patients than need additional monitoring (ICU etc.)* *This can be very time consuming if not.* *Not to waste time but to be accurate* *Follow up on adherence to regulations* *…risk and safety needs a specific department that continuously reviews the facility for these factors*	2	2

Figure 36 Risk and Safety Factors

***Please note: The comments in blue were made under "Additional Comments' in the Expert Sample Instrument and redistributed based on theme.**

The overall rating of the value added by consideration of risk and safety in healthcare building design and operation was 4.79. Five of the sub-factors under Risk and Safety were given universal affirmation of adding value to a healthcare facility; 'Well-developed safety standards', 'Fire/containment doors', 'Emergency equipment readily available and accessible and regularly maintained', 'Emergency routes/exits clearly established and marked' and 'Hazardous materials appropriately handled within an established system'.

‘Clear and visible procedures for emergency situations established’ was affirmed as adding value by 13 of the 14 participants in the sample: This suggests concurrence with study findings that factors related to building design and the built environment can have a positive or negative impact on risk and patient safety (Joseph & Rashid, 2008; Ulrich et al., 2008).

Three of the sub-factors were related directly to procedures for patient medical safety; ‘Clear and consistently checked patient identification’ which receive affirmation from 11 of the 14 as adding value, and ‘Patient handover is minimized and consists of a comprehensive review of patient’s condition and care needs at handover’ which was affirmed to add value by 12 of the sample and ‘Clear and consistent patient visibility’ by 11 of the 14.

The themes that emerged from the Risk and Safety factors were: ‘General Safety’, ‘Patient Safety’, and ‘Need for Oversight’.

The sub-factors under patient safety were related to the control methods in place to ensure patient safety. These included ‘Clear and consistently checked patient identification’, ‘Clear and consistent patient visibility’, and ‘Patient handover minimized and comprehensive’. Comments related to the first of these, ‘Clear and consistently checked patient identification’ were: *‘This should be standard procedure’* and ‘*This*

reduces the risk of medical errors'. The need for *'clear and consistent patient visibility'* was commented on as being '…*very important in units for patients than need additional monitoring (ICU etc.*). Comments related to the need to minimize the time needed for patient handover while maintaining a comprehensive briefing of staff taking were related to time: '*This can be very time consuming if not'* and '*Not to waste time but to be accurate*'.

Comments also noted a need for oversight on risk and safety: '*Follow up on adherence to regulations'* and '…risk and safety needs a specific department that continuously reviews the facility for these factors'.

Based on the data, the Expert Sample resulted in a validation of all of the factors extracted from the literature review, with the exception of 'age of building', under Building Design.

4.2.3 Factors in Descending Order of Value

Factor	Average
1. Medical	4.93
2. Professional	4.93
3. Operational	4.86
4. Procedural	4.86
5. Risk and Safety	4.79
6. Location/Accessibility	4.79
7. Staff care and Attitude	4.71
8. Technical	4.64

9. Patient's Room	4.5
10. Policy	4.36
11. Spiritual	4.14
12. Economic	4.29
13. Building Design	4.07
14. Cultural	3.99

Table 33 Factors in Descending Order of Perceived Added Value

Although the first instrument included factors indirectly rather than directly related to building design, for the purpose of the second instrument, the factors directly related to building design were extracted and a second thematic analysis was undertaken in order to develop the criteria for the AHP. This is shown in the following Table (34).

4.3 Breakdown of Themes for AHP Criteria

	Criteria	Factors included within this criteria
1.	**Accessibility and Way-finding**	• Location of and Ease identification of Entrances • Sufficient, convenient parking • Well-planned internal traffic flow • Clear and Sufficient Way-Finding/Signage
2.	**Functionality**	• Centralized Department Layout • Organization of work flow • Ease of access to and distribution of Supplies /equipment • Proximity of Operating Room to key locations • Location of ER in relation to Clinics
3.	**Aesthetics, comfort and Well-being**	• Single patient rooms • Art Displayed • Natural views • Lighting and Air quality • Accommodations for visitors • Spiritual/Quiet spaces (gardens, meditation, religious spaces)
4.	**Cost**	• Initial building cost • Maintenance Costs • Cost of medical care
5.	**Cultural factors**	• Mosques

		• Qibla direction clearly marked • Accommodations for caretaker • Separate male/female waiting rooms • Provision for personal décor items to be brought to patients' rooms (bedding, small tables, etc.)
6.	**Risk and Safety**	• Adherence to all fire safety regulations • Adherence to all risk and safety regulations

Table 34 Breakdown of Themes for AHP Criteria

For the purpose of the second survey instrument, the themes were re-grouped into the six major criteria of Accessibility and Way-finding, Functionality, Aesthetics, comfort and Well-being, Cost, Cultural factors and Risk and Safety factors that related to the built design of the facilities. Each main criterion has a number of related sub-criteria which were used to enhance the understanding of the participants of factors included in the main category. It should be noted that cost was included in relation to how design affects cost in relation to the three sub-factors.

4.4 Chapter Summary

In this chapter the data gained from the first instrument have undergone thematic analysis and the results have been discussed. In the following chapter, the data gained from the second instrument is presented.

CHAPTER V

AHP INSTRUMENT DATA ANALYSIS AND RESULTS

5.1 Introduction to Chapter 5

This chapter presents the analysis of the data generated by the AHP survey instrument. The following sections will discuss the data collected through the AHP survey and their methods of analysis in detail. The final section of this chapter discusses the findings and conclusions drawn from the data analysis of the AHP survey instrument.

5.2 The Sample

Elf, Fröst, Lindahl, & Wijk, (2015) suggest that the design process should be the result of shared-decision making and planning between representatives from healthcare, construction sector and architecture , and that those decisions should be based on based on evidence and end-users' perspectives. Thus the sample for the second instrument were specifically chosen to provide a multi-user perspective within the constraints of an AHP instrument which is not suited to large samples.

Snowball sampling was used for the second survey instrument to ensure a multi-user perspective. Glesne, (2011) proposes that gaining the perspectives of several members of the same social group about commonly experienced phenomena can provide insight into cultural patterns of thought and action for that group. However, due to the unsuitability of AHP fr large groups of participants, the number of participants was limited to 20. Thus, the sample consisted of 20 participants selected for their status in the following distribution: 5 architects/engineers, 5 high level administrators of healthcare facilities, five

individuals who had been inpatients in a healthcare facility in the Kingdom within the last two years for longer than 5 days, and five individuals who had visited patients at a minimum of two different healthcare facilities in Saudi Arabia within the last year. To ensure their understanding of what each of the six criteria encompassed, participants were given oral and written clarification and offered assistance (over Zoom due to COVID 19) if they needed further clarification of any of the factors. Participants were instructed to refer to the sub-factors in order to fully understand what the main criterion was intended to encompass. All the sub-factors, with the exception of cost of medical care were directly related to building design.

5.3 The Instrument

The AHP instrument consisted of 6 main criteria and 25 sub-factors which resulted in 60 pairwise comparisons for which the participants were asked to give comparison rankings based on perceptions of the compared priority of what criteria/factor over another.

5.4 Demographic Data

What is your age?		Percentage	Status		Percentage
18-24	1	5%	Administrator in healthcare facility	5	25%
25-34	4	20%	Architect	3	15%
35-44	9	45%	Engineer	2	10%
45-54	3	15%	Patient	5	25%

Above 54	3	15%	Visitor	5	25%
Totals	20	100%		20	100%

Table 35 Demographic Data for AHP Instrument

As can be seen, the participants were all over 18 years of age, and fit the chosen 'expert' status as healthcare facility administrators, architects, engineers, patients or visitors.

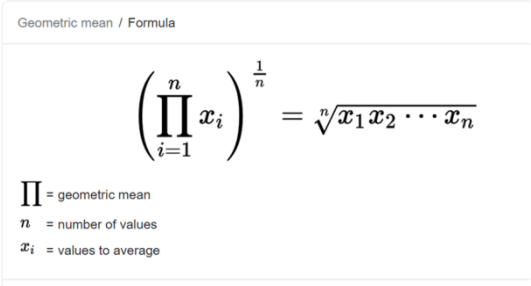
5.5 Method used to Obtain Data Result

In the following section the methods used to analyze the AHP results and the data generated will be presented.

5.5.1 Geometric Mean

The first step in analyzing the results was to determine the geometric mean of the combined rankings from all of the participants.

The geometric means of the combined results of the pairwise comparison were obtained in order to obtain the pairwise comparison weights of each set of factors using the formula below.



5.5.2 AHP Online Calculator

Once the geometric mean for the group pairwise comparison was obtained, the resulting data was inserted in an online AHP calculator developed by Business Performance Management Singapore (BPMSG). The results were then verified using the AHP Calculation software by CGI.

5.5.3 Consistency Ratio

The final step was to check the validity of the data by calculating the consistency ration. The Consistency Ratio is calculated by dividing the Consistency Index for the set of judgments by the Index for the corresponding random matrix. Saaty proposes that if a ratio exceeds 0.1 the set of judgments may be too inconsistent to be reliable: however, he allows for a higher acceptable consistency ratio of up to 0.2 when there are a number of people involved in the pairwise comparison.

5.6 Main Criteria

5.6.1 Geometric Mean (Rounded)

	Option A	Geometric mean	Option B
1.	Accessibility and Way-finding	**1**	Functionality
2.	Accessibility and Way-finding	5	Aesthetics/comfort and well-being
3.	Accessibility and Way-finding	3	Cultural Factors

4.	Accessibility and Way-finding	7	Cost
5.	Accessibility and Way-finding	4	Risk and Safety
6.	Functionality	3	Aesthetics/comfort and well-being
7.	Functionality	4	Cultural Factors
8.	Functionality	3	Cost
9.	Functionality	5	Risk and Safety
10.	Aesthetics/comfort and well-being	**1**	Cultural Factors
11.	Aesthetics/comfort and well-being	3	Cost
12.	Aesthetics/comfort and well-being	5	Risk and Safety
13.	Cultural Factors	5	Cost
14.	Cultural Factors	3	Risk and Safety
15.	Risk and Safety	7	Cost

Table 36 Geometric Mean of Main Criteria

5.6.2 Pairwise Comparisons Main Criteria

	Accessibility and Way-finding	Functionality	Aesthetics / comfort and well-being	Cultural Factors	Cost	Risk and Safety
Accessibility and Way-finding	**1**	**1.0**	**5.0**	**3.0**	**7.0**	**¼**

Functionality	**1.0**	**1**	**3.0**	**4.0**	**3.0**	**1/5**
Aesthetics/ comfort and well-being	**1/5**	**1/3**	**1**	**1.0**	**3.0**	**1/5**
Cultural Factors	**1/3**	**1/4**	**1.00**	**1**	**3.00**	**1/3**
Cost	**1/7**	**1/3**	**1/3**	**1/3**	**1**	**1/7**
Risk and Safety	**4.0**	**5.0**	**5.0**	**3.0**	**7.0**	**1**

Table 37 Parwise Comparison of Main Criteria

5.6.3 Consistency Ratio

C.R. = 7.9% or 0.079 < 0.1

The resulting consistency ratio is equal to 7.9% or 0.079, which is less than the value (0.1), so it is acceptable.

5.6.4 Priority and Rankings

Cat		Priority (Rounded Eigen Vector)	Rank	+	_
1.	Accessibility and Way-finding	**20.1%**	**2**	**7.2%**	**7.2%**
2.	Functionality	**16.7%**	**3**	**7.5%**	**7.5%**

3.	Aesthetics/ comfort and well-being	**6.8%**	**5**	**2.2%**	**2.2%**
4.	Cultural Factors	**7.9%**	**4**	**3.5%**	**3.5%**
5.	Cost	**3.6%**	**6**	**1.6%**	**1.6%**
6.	Risk and Safety	**44.9%**	**1**	**24.9**	**24.9**

Table 38 Priority and Rankings of Main Criteria

5.6.5 Redistribution of Factors based on Ranking

Cat		Priority	Rank
1.	Risk and Safety	**44.9%**	1
2.	Accessibility and Way-finding	**20.1%**	**2**
3.	Functionality	**16.7%**	**3**
4.	Cultural Factors	**7.9%**	**4**
5.	Aesthetics/ comfort and well-being	**6.8%**	**5**
6.	Cost	**3.6%**	**6**

Table 39 Redistribution of Main Criteria by Ranking

Risk and Safety received the highest ranking of the six factors with 44.9%. This was followed by Accessibility and Way-Finding with 20.1%. Functionality ranked third, with 16.7%, Cultural factors were fourth, with 7.9%, followed by Aesthetics/Comfort and Well-being with 6.8%, and with Cost ranking last with 3.6%.

5.7 Sub-Factors Accessibility and Way-finding

The four sub-factors under Accessibility and Way-finding were Location and Identification of entrances, Sufficient, Convenient Parking, Well planned internal traffic flow and Clear and Sufficient Way-Finding/Signage. The results of the pairwise comparison of these sub-factors can be seen in the tables below.

5.7.1 Geometric Mean (Rounded)

	Option A	Geometric mean	Option B
1.	Location and Identification of entrances	**1**	Sufficient, Convenient Parking
2.	Location and Identification of entrances	1	Well Planned Internal Traffic Flow
3.	Location and Identification of entrances	1	Clear and Sufficient Way-Finding/Signage
4.	Sufficient, Convenient Parking	3	Well Planned Internal Traffic Flow
5.	Sufficient, Convenient Parking	3	Clear and Sufficient Way-Finding/Signage
6.	Well Planned internal Traffic Flow	1	Clear and Sufficient Way-Finding/Signage

Table 40 Geometric Mean of Sub-factors Accessibility and Way Finding

5.7.2 Pairwise Comparisons

	Location and Identification of entrances	Sufficient, Convenient Parking	Well planned internal traffic flow	Clear and Sufficient Way-Finding/ Signage
Location and Identification of entrances	**1**	**1.0**	**1.0**	**1.0**
Sufficient, Convenient Parking	**1.0**	**1**	**1/3**	**1/3**
Well planned internal traffic flow	**1.0**	**3.0**	**1**	**1.0**

Clear and Sufficient Way-Finding/Signage	**1.0**	**3.0**	**1.00**	**1**

Table 41Pairwise Compariosn of Sub-Factors Accessibility and Way Finding

5.7.3 Consistency Ratio

C.R. = 5.7% or 0.057 < 0.1

The resulting consistency ratio is equal to 5.7 % or 0.057, which is less than the value (0.1), so it is acceptable.

5.7.4 Priority and Rankings

Cat		Priority (Rounded Eigen Vector)	Rank	+	_
1.	Location and Identification of entrances	**24.1%**	**3**	**7.6%**	**7.6%**
2.	Sufficient, Convenient Parking	**14.2%**	**4**	**6.3%**	**6.3.5%**
3.	Well planned internal traffic flow	**30.9**	**1**	**7.4 %**	**7.4 %**
4.	Clear and Sufficient Way-Finding/Signage	**30.9**	**1**	**7.4 %**	**7.4 %**

Table 42 Priority and Rankings of Sub- Factors Location and Way Finding

5.7.5 Redistribution of Factors based on Ranking

Cat		Priority	Rank
1.	Well planned internal traffic flow	**30.9%**	1
2.	Clear and Sufficient Way-Finding/Signage	**30.9%**	**1**
3.	Location and Identification of entrances	**24.1%**	**3**

4.	Sufficient, Convenient Parking	**14.2 %**	**4**

Table 43 Redistribution of Sub Factors of Accessibility and Way Finding by Ranking

The factors with the highest rankings were Well planned internal traffic flow and Clear and Sufficient Way-Finding/Signage both of which had a priority ranking of 30.9%/ This was followed by Location and Identification of entrances with a ranking of 24.1% and finally Sufficient and Convenient Parking with 14.2 %.

5.8 Sub-Factors Functionality

There were five sub-factors under Functionality. These were Centralized Department Layout,

Organization of Workflow, Access to and Distribution of Supplies/Equipment, Proximity of Operating Theatres to Key Locations and the Location of ER in relation to Clinics. The results of the pairwise comparison of these sub- factors can be seen in the tables below.

5.8.1 Geometric Mean (Rounded)

	Option A	Geometric mean	Option B
1.	Centralized Department Layout	**5**	Organization of Work flow
2.	Centralized Department Layout	5	Access to and distribution of Supplies /equipment

3.	Centralized Department Layout	3	Proximity of OR to Key Locations
4.	Centralized Department Layout	3	Location of ER in relation to Clinics
5.	Organization of Work flow	3	Access to and distribution of Supplies /equipment
6.	Organization of Work Flow	5	Proximity of OR to Key Locations
7.	Organization of Work Flow	5	Location of ER in relation to Clinics
8.	Access to and distribution of Supplies /equipment	5	Proximity of OR to Key Locations
9.	Access to and distribution of Supplies /equipment	5	Location of ER in relation to Clinics
10.	Access to and distribution of Supplies /equipment	1	Location of ER in relation to Clinics

Table 44 Geometric Mean of Sub-Factors of Functionality

5.8.2 Pairwise Comparisons

	Centralized Department Layout	Organization of Workflow	Access to and Distribution of Supplies/ Equipment	Proximity of OR to Key Locations	Location of ER in relation to Clinics
Centralized Department Layout	**1**	**5.0**	**5.0**	**1/3**	**1/3**
Organization of Workflow	**1/5**	**1**	**1/3**	**1/5**	**1/5**
Access to and Distribution of Supplies/Equipment	**1/5**	**3.0**	**1**	**1/5**	**1/5**
Proximity of OR to Key Locations	**3.0**	**5.0**	**5.0**	**1**	**1.0**
Location of ER in relation to Clinics	**3.0**	**5.0**	**5.0**	**1.0**	**1**

Table 45 Pairwise Comparison of Sub-factors of Functionality

5.8.3 Consistency Ratio

C.R. = 7.8% or 0.078 < 0.1

The resulting consistency ratio is equal to 7.8 % or 0.078, which is less than the value (0.1), so it is acceptable.

5.8.4 Priority and Rankings

Cat		Priority (Rounded Eigen Vector)	Rank	+	_
1.	Centralized Department Layout	**18.9%**	**3**	**9.5%**	**9.5%**
2.	Organization of Workflow	**14.6%**	**4**	**1.9 %**	**1.9 %**
3.	Access to and Distribution of Supplies/Equipment	**7.2%**	**5**	**3.4 %**	**3.4 %**
4.	Proximity of OR to Key Locations	**34.6%**	**1**	**11.4 %**	**11.4 %**
5.	Location of ER in relation to Clinics	**34.6%**	**1**	**11.4 %**	**11.4%**
					11.5

Table 46 Priority and Rankings of Sub-factors of Functionality

5.8.5 Redistribution of Factors based on Ranking

Cat		Priority	Rank
1.	Proximity of OR to Key Locations	**34.6%**	**1**
2.	Location of ER in relation to Clinics	**34.6%**	**1**
3.	Centralized Department Layout	**18.9%**	**3**
4.	Organization of Workflow	**14.6%**	**4**
5.	Access to and Distribution of Supplies/Equipment.	**7.2%**	**5**

Table 47 Redistribution of Sub-factors of Functionality by Ranking

The two highest ranking factors were Proximity of Operating Theatre to Key Locations and Location of Emergency Room in relation to Clinics; both of these factors received a priority ranking of 34.6%. This was followed by Centralized Department Layout in third place with a priority ranking of 18.9%, then Organization of Workflow with 14.6.% and finally Access to and Distribution of Supplies/Equipment with 7.2%.

5.9 Sub-Factors Aesthetics/comfort and well-being

The criteria of Aesthetics/Comfort and well-being had the greatest number of sub-factors. The six sub-factors were Single Patient Rooms Art Displayed, Natural Views, Lighting and Air quality, Accommodations for Visitors and Spiritual/Quiet Places. The results of the pairwise comparison of these sub- factors can be seen in the tables below.

5.9.1 Geometric Mean (Rounded)

	Option A	Geometric mean	Option B
1.	Single Patient Rooms	**7**	Art Displayed
2.	Single Patient Rooms	5	Natural Views
3.	Single Patient Rooms	1	Lighting and Air quality
4.	Single Patient Rooms	3	Accommodations for Visitors
5.	Single Patient Rooms	5	Spiritual/Quiet Places
6.	Art Displayed	5	Natural Views
7.	Art Displayed	9	Lighting and Air quality
8.	Art Displayed	9	Accommodations for Visitors
9.	Art Displayed	7	Spiritual/Quiet Places
10.	Natural Views	5	Lighting and Air quality
11.	Natural Views	5	Accommodations for Visitors
12.	Natural Views	1	Spiritual/Quiet Places
13.	Lighting and Air Quality	1	Accommodations for Visitors
14.	Lighting and Air Quality	3	Spiritual/Quiet Places

15.	Accommodations for Visitors	5	Spiritual/Quiet Places

Table 48 Geometric Mean of Sub-factors of Aesthetics/Comfort and Well being

5.9.2 Pairwise Comparisons

	Single Patient Rooms	Art Displayed	Natural Views	Lighting and Air quality	Accommodations for Visitors	Spiritual/Quiet Places
Single Patient Rooms	**1**	**7.0**	**5.0**	**1.0**	**3.0**	**5.0**
Art Displayed	**1/7**	**1**	**1/5**	**1/9**	**1/9**	**1/7**
Natural Views	**1/5**	**5.0**	**1**	**1/5**	**1/5**	**1.0**
Lighting and Air quality	**1.0**	**9.0**	**5.0**	**1**	**1.0**	**3.0**
Accommodations for Visitors	**1/3**	**9.0**	**5.0**	**1.0**	**1**	**5.0**
Spiritual/Quiet Places	**1/5**	**7.0**	**1.0**	**1/3**	**1/5**	**1**

Table 49 Pairwise Comparison of Sub-factors of Aesthetics/Comfort and Well-being

5.9.3 Consistency Ratio

C.R. = 7.1 % or 0.071 < 0.1

The resulting consistency ratio is equal to 7.1 % or 0.071, which is less than the value (0.1), so it is acceptable.

5.9.4 Priority and Rankings

Cat		Priority (Rounded Eigen Vector)	Rank	+	_
1.	Single Patient Rooms	**34.2%**	**1**	**17.7%**	**17.7%**
2.	Art Displayed	**2.3 %**	**6**	**1.3 %**	**1.3 %**
3.	Natural Views	**6.7 %**	**5**	**2.4 %**	**2.4 %**
4.	Lighting and Air quality	**25.0%**	**2**	**5.1%**	**5.1%**
5.	Accommodations for Visitors	**23.9%**	**3**	**9.1 %**	**9.1 %**
6.	Spiritual/Quiet Places	**7.9 %**	**4**	**3.8%**	**3.8%**

Table 50 Priority Rankings of Sub- Factors of Aesthetics/Comfort and Well-being

5.9.5 Redistribution of Factors based on Ranking

Cat		Priority	Rank
1.	Single Patient Rooms	34.2%	1
2.	Lighting and Air quality	25.0%	2
3.	Accommodations for Visitors	23.9%	3
4.	Spiritual/Quiet Places	7.9 %	4
5.	Natural Views	6.7 %	5
6.	Art Displayed	2.3 %	6

Table 51 Redistribution of Sub-factors of Aesthetics/Comfort and Well-being by Ranking

The highest priority ranking under Aesthetics/comfort and well-being was given to Single Patient Rooms with 34.2%. This was followed by Lighting and Air quality with 25.0%. The sub-factor Accommodations for Visitors was in third place with 23.9%. Spiritual and Quiet Places ranked fourth with 7.9%. Natural Views was in fifth place with 6.7% and Art Displayed had the lowest ranking with 2.3%.

5.10 Sub-Factors Cultural Factors

The five sub-factors under Cultural factors were Mosques, Room layout/signage which facilitates prayer (Qibla), Accommodations for caretaker, Separate male/female waiting rooms, and the Provision for personal décor items. The results of the pairwise comparison of these sub- factors can be seen in the tables below.

5.10.1 Geometric Mean (Rounded)

	Option A	Geometric mean	Option B
1.	Mosques	**1**	Room layout/signage which facilitates prayer (Qibla)
2.	Mosques	5	Accommodations for caretaker
3.	Mosques	7	Separate male/female waiting rooms
4.	Mosques	5	Provision for Personal Décor Items
5.	Room layout/signage which facilitates prayer (Qibla)	3	Accommodations for caretaker
6.	Room layout/signage which facilitates prayer (Qibla)	5	Separate male/female waiting rooms
7.	Room layout/signage which facilitates prayer (Qibla)	3	Provision for Personal Décor Items
8.	Accommodations for caretaker	5	Separate male/female waiting rooms
9.	Accommodations for caretaker	7	Provision for Personal Décor Items

10.	Separate male/female waiting rooms	3	Provision for Personal Décor Items

Table 52 Geometric Mean for Cultural Sub-Factors

5.10.2 Pairwise Comparisons

	Mosques	Room layout/signage which facilitates prayer (Qibla)	Accommodations for caretaker	Separate male/female waiting rooms	Provision for personal décor items
Mosques	**1**	**1.0**	**1/5**	**7.0**	**5.0**
Room layout/signage which facilitates prayer (Qibla)	**1.0**	**1**	**1/3**	**5.0**	**3.0**
Accommodations for caretaker	**5.0**	**3.0**	**1**	**5.0**	**7.0**
Separate male/female waiting rooms	**1/7**	**1/5**	**1/5**	**1**	**1/3**
Provision for personal décor items	**1/5**	**1/3**	**1/7**	**3.0**	**1**

Table 53 Pairwise Comparison of Cultural Sub-factors

5.10.3 Consistency Ratio

C.R. = 9.8% or 0.098 < 0.1

The resulting consistency ratio is equal to 9.8 % or 0.098, which is less than the value (0.1), so it is acceptable.

5.10.4 Priority and Rankings

Cat		Priority (Rounded Eigen Vector)	Rank	+	_
1.	Mosques	**20.6%**	**2**	**8.7%**	**8.7%**
2.	Room layout/signage which facilitates prayer (Qibla)	**17.8 %**	**3**	**1.8 %**	**1.8 %**
3.	Accommodations for caretaker	**50.6 %**	**1**	**27.2 %**	**27.2 %**
4.	Separate male/female waiting rooms	**4.2%**	**5**	**2.9 %**	**2.9 %**
5.	Provision for personal décor items	**6.8%**	**4**	**3.0 %**	**3.0%**

Table 54 Priority and Ranking of Cultural Sub-Factors

5.10.5 Redistribution of Factors based on Ranking

Cat		Priority	Rank
1.	Accommodations for caretaker	**50.6 %**	**1**
2.	Mosques	**20.6%**	**2**
3.	Room layout/signage which facilitates prayer (Qibla)	**17.8 %**	**3**
4.	Provision for personal décor items	**6.8%**	**4**
5.	Separate male/female waiting rooms	**4.2%**	**5**

Table 55 Redistribution of Cultural Sub-factors by Ranking

Accommodations for caretaker were given the highest priority ranking with 50.6%. The presence of Mosques ranked second with 20.6%. Room layout/signage which facilitates prayer (Qibla) ranked third with 17.8%. The two lowest ranked factors were Provision for the use of personal décor items in patients' rooms, with 6.8%, and Separate male/female waiting rooms with 4.2%

5.11 Sub-Factors Cost

The main criteria of Cost had three sub-factors: Initial Building costs, Maintenance Costs, and Medical Care Costs. The results of the pairwise comparison of these sub- factors can be seen in the tables below.

5.11.1 Geometric Mean (Rounded)

	Option A	Geometric mean	Option B
1.	Initial Building costs	**4**	Maintenance Costs
2.	Initial Building costs	5	Medical Care Costs
3.	Maintenance Costs	7	Medical Care Costs

Table 56 Geometric Mean for Cost Sub-Factors

5.11.2 Pairwise Comparisons

	Initial Building costs	Maintenance Costs	Medical Care Costs
Initial Building costs	**1**	**4.0**	**1/5**
Maintenance Costs	¼	**1**	**1/7**
Medical Care Costs	**5.0**	**.0**	**1**

Table 57 Pairwise Comparison of Cost Sub-Factors

5.11.3 Consistency Ratio

C.R. = 12.9% or 0.129 > 0.1

The resulting consistency ratio is equal to 12.9 % or 0.129, which is greater than the value (0.1); however, consistency values of higher than 0.1 and up to 0.15 (Saaty, 1990) are acceptable when the pairwise comparison is done by a group.

5.11.4 Priority and Rankings

Cat		Priority (Rounded Eigen Vector)	Rank	+	_
1	Initial Building costs	**20.5%**	**2**	**7.1 %**	**7.1 %**
2	Maintenance Costs	**7.83 %**	**3**	**2.5 %**	**2.5 %**
3	Medical Care Costs	**72.2%**	**1**	**24.9%**	**24.9%**

Table 58 Priority and Ranking of Cost Sub-Factors

5.11.5 Redistribution of Factors based on Ranking

Table 59 Redistribution of Cost Sub-factors by Ranking

Cat		Priority	Rank
1.	Medical Care Costs	72.2%	1
2.	Initial Building costs	20.5%	2
3.	Maintenance Costs	7.83 %	3

The highest priority ranking was given to Medical Care Costs, with 72.2%, Initial Building cost ranked second with 20.5% and Maintenance Costs third with 7.83%.

5.12 Risk and Safety

There were only two factors under the main Criteria of Risk and Safety. These were Design adheres to all fire safety regulations, and Design adheres to all risk and safety regulations. The results of the pairwise comparison of these sub- factors can be seen in the tables below.

5.12.1 Geometric Mean (Rounded)

	Option A	Geometric mean	Option B
1.	Adherence to fire safety regulations	**2**	Adherence to Medical risk and safety regulations

Table 60 Geometric Mean for Risk and Safety Sub- Factors

5.12.2 Pairwise Comparisons

	Adherence to fire safety regulations	Adherence to Medical risk and safety regulations
Adherence to fire safety regulations	**1**	**0.50**
Adherence to Medical risk and safety regulations	**2.0**	**1**

Table 61 Pairwise Comparison of Cost Sub-Factors

5.12.3 Consistency Ratio

C.R. = 0.0 % or 0.0 < 0.1

As this was a single comparison between only two sub-factors the resulting Consistency Ratio CR = 0.0%

5.12.4 Priority and Rankings

Cat		Priority (Rounded Eigen Vector)	Rank	+	_
1	Adherence to fire safety regulations	**33.3%**	**2**	**0 .0 %**	**0 .0 %**
2	Adherence to Medical risk and safety regulations	**66.6 %**	**1**	**0 .0 %**	**0 .0 %**

Table 62 Priority and Ranking of Cost Sub-Factors

5.12.5 Redistribution of Factors based on Ranking

Cat		Priority (Rounded Eigen Vector)	Rank
1	Adherence to Medical risk and safety regulations	**66.6 %**	**1**
2	Adherence to fire safety regulations	**33.33%**	**2**

Table 63 Redistribution of Cost Sub-factors by Ranking

The single comparison for the Risk and Safety factors resulted in a ranking priority that gives Adherence to Medical risk and safety regulations double the priority ranking of Adherence to fire safety regulations.

5.13 Combined Results

The combined results of the priority rankings for the main criteria and sub-factors can be seen in the table below.

	Criteria in Order of Priority	Priority (Rounded Eigen Vector	Specific Design Factors in order or Priority Ranking	Priority (Rounded Eigen Vector
1.	**Risk and Safety**	44.9%	• Design adheres to all medical risk and safety regulations	66.6 %
			• Design adheres to all fire safety regulations	33.33%
2.	**Accessibility and Way-finding**	20.1%	• Well planned internal traffic flow	30.9%
			• Clear and Sufficient Way-Finding/Signage	30.9%
			• Location and Identification of entrances	24.1%
			• Sufficient, Convenient Parking	14.2 %
3.	**Functionality**	16.7%	• Proximity of OR to Key Locations	34.6%
			• Location of ER in relation to Clinics	34.6%
			• Centralized Department Layout	18.9%
			• Organization of Workflow	14.6%
			• Access to and Distribution of Supplies/Equipment	7.2%
4.	**Cultural factors**	7.9%	• Accommodations for caretaker	50.6 %
			• Mosques	20.6%
			• Room layout/signage which facilitates prayer (Qibla)	17.8 %
			• Provision for personal décor items to be brought to patients' rooms (bedding, small tables, etc.)	6.8%
			• Separate male/female waiting rooms	4.2%

5.	**Aesthetics, comfort and Well-being**	6.8%	• Single Patient Rooms	34.2%
			• Lighting and Air quality	25.0%
			• Accommodations for Visitors	23.9%
			• Spiritual/Quiet spaces (gardens, meditation, religious spaces)	7.9 %
			• Natural Views	6.7 %
			• Art Displayed	2.3 %
6.	**Cost**	3.6%	• Cost of medical care	72.2%
			• Initial building cost	20.5%
			• Maintenance Costs	7.83 %

Table 64 Combined Ranking Results for Main Criteria and Sub-Factors

5.14 Chapter Summary

In this chapter the results of the second instrument, the AHP survey were presented along with the weighted rankings of the six main criteria and the sub-factors.

The synthesized results of the two instruments will be discussed in the upcoming chapter.

CHAPTER VI

DISCUSSION

Introduction to Chapter 6

In this chapter the results of the data from the two instruments in Chapters 4 and 5 are synthesized and discussed.

6.1 Discussion of Results

The data gained from the first instrument had a dual purpose. It was initially used to determine the criteria and sub-factors to be included in the AHP pairwise comparison survey. The second purpose was to synthesize the data from the first instrument with the data from the second instrument in order to propose a framework based on both quantitative and qualitative data results.

The first instrument included factors related to quality of medical care and outcomes not directly but are rather indirectly related to building design. The results show that the factors related to quality of medical care and outcomes at the healthcare facility (as seen in table 65) such as medical, professional, operational and procedural factors, were given higher ratings of importance than the factors related to the design of the building itself. However, in comparing the results directly related to the healthcare building there are noted similarities of the perception of the importance of the majority of the factors.

Factor	Average	Rounded Average	Level of Importance
1. Medical	4.93	5	Very Important
2. Professional	4.93	5	Very Important
3. Operational	4.86	5	Very Important
4. Procedural	4.86	5	Very Important
5. Risk and Safety	4.79	5	Very Important
6. Location/Accessibility	4.79	5	Very Important
7. Staff care and Attitude	4.71	5	Very Important
8. Technical	4.64	5	Very Important
9. Patient's Room	4.5	5	Very Important
10. Policy	4.36	4	Important
11. Spiritual	4.14	4	Important
12. Economic	4.29	4	Important
13. Building Design	4.07	4	Important
14. Cultural	3.99	4	Important

Table 65 Combined Results Instrument 1

Cat		Priority	Rank
1.	Risk and Safety	**44.9%**	1
2.	Accessibility and Way-finding	**20.1%**	**2**
3.	Functionality	**16.7%**	**3**
4.	Cultural Factors	**7.9%**	**4**
5.	Aesthetics/comfort and well-being	**6.8%**	**5**
6.	Cost	**3.6%**	**6**

Table 66 Main Criteria Rankings Instrument 2

6.2 Risk and Safety

Risk and Safety emerged as the most important factor to be considered when designing a healthcare building with a comparison weight against the other main criteria of 44.9%, and a rating of 4.79/5 (or Very Important when rounded) in adding value on the first instrument. Five of the sub-factors under Risk and Safety were given a 100% affirmation of adding value to a healthcare facility; 'Well-developed safety standards', 'Fire/containment doors', 'Emergency equipment readily available and accessible and regularly maintained', 'Emergency routes/exits clearly established and marked' and 'Hazardous materials appropriately handled within an established system'. 'Clear and visible procedures for emergency situations established' was affirmed as adding value by 93% of the sample: This suggests concurrence with study findings that factors related to building design and the built environment can have a positive or negative impact on risk and patient safety (Joseph & Rashid, 2008; Ulrich et al., 2008).

6.3 Accessibility and Way Finding

the factor that has the second highest rating on the second instrument 'Accessibility and Way Finding' with a comparison weight of 20.1%, is also ranked as 'Very Important' on the first instrument (Location and Accessibility) with a rating of 4.79/5. This concurs with Volker, Lauche, Heintz, & de Jonge's (2008) proposal that a quality healthcare environment should be easily accessible and navigated (Volker, Lauche, Heintz, & de Jonge, 2008). All of the participants in the first instrument sample validated 'Ease of Access and Navigation' as adding value to healthcare facility design. In addition, the results of the first survey suggest that sufficient parking, proximity of parking space to buildings, and ease of access to building entry points to be of greater value than the actual geographical location of the facility.

6.4 Functionality

The third ranking factor on the second instrument was Functionality with a weighted comparison ranking of 16.7%. The factor of Functionality was considered to include design factors such as centralized department layout, ease of access to and distribution of supplies /equipment, proximity of operating room to key locations and the location of clinics in relation to entrance. In the first instrument these were included under operational and procedural factors, both of which were given a rating (4.86) of 'Very Important'.

On the second instrument, the two highest ranking factors were 'Proximity of Operating Theatre to Key Locations' and 'Location of Emergency Room in relation to Clinics'; both of these factors received a priority ranking of 34.6%. 85% of the participants in the first

survey sample agreed that the strategic location of operating theatres added value. This was followed by Centralized Department Layout in third place with a priority ranking of 18.9%, then Organization of Workflow with 14.6.% and finally Access to and Distribution of Supplies/Equipment with 7.2%.

The results of the second instrument suggest that Access to and Distribution of Supplies and Equipment is of less importance than the other sub-factors under Functionality, In Contrast, the value added by ease of access to and distribution of supplies, equipment was affirmed by the first instrument with statements such as 'Well planned logistics for smooth transport of beds, bedclothes, food, medical facilities separate to patient traffic flows' affirmed to add value by 100% of the sample in the first, as was a 'Well developed and efficient inventory and ordering system' and a 'Clearly established operational plan for logistics and supplies' was affirmed to add value by 86%. However, the sub-factor receiving the lowest number of affirmative responses of adding value was 'Well-considered distribution points' with only 64% affirming its value.

Studies have shown that the quick and easy formation of multidisciplinary teams within a hospital can improve communication, reduce risks, improve outcomes, and decrease length of patient stay, and positively impact staff and patient satisfaction (Epstein, 2014) and the ability for this to be done quickly and efficiently is directly related to the functional layout of the healthcare building. Carr (2017) suggests minimizing travel distance between commonly visited spaces, locating support spaces so that they can be shared

by adjacent functional areas, and grouping and combining areas with similar functional needs.

6.5 Cultural Factors

The two instruments differ in relation to the perceptions of the value added by the incorporation of cultural aspects into the building design. On the second instrument, this factor was rated fourth, above ‘Aesthetics/comfort and well-being’ and ‘Cost’, whereas on the first instrument is was given the lowest ranking of importance in adding value. However, it should be noted that the second instrument combined cultural factors with factors related to the Islamic religion such as the presence of mosques and room layout and signage which facilitates prayer, whereas the first instrument separated these factors into cultural and spiritual. In addition, the first instrument sample consisted of individuals with working experience in a Saudi healthcare facility in a professional capacity, whereas the second instrument had a multi-user perspective; therefore, the possibility that contradictory results could be related to a diversity in perspective (staff vs. other users) must be considered.

Accommodations for caretaker were given the highest priority ranking with 50.6%. The presence of Mosques ranked second with 20.6%. Room layout/signage which facilitates prayer (Qibla) ranked third with 17.8%.

The need for accommodations for a caretaker in the patient’s room 24/7 (including sleeping facilities and provision of meals) which was seen as being beneficial to staff in

terms of saving time and effort by caretaker assisting patient with non-medical needs, and patient comfort and well-being was one of the cultural factors specific to Saudi Arabia that emerged. Comments made in the first instrument under the sub-factor, 'Caretaker allowed to remain with patient 24/7' support the UK Department of Health, research findings that allowing relatives to remain with a patient and providing facilities to accommodate them can result in several benefits, including reductions in nurse-call button activity, and in patient falls (Health Building Note 00-01, pg. 36, 2014).

The two lowest ranked factors on the second instrument were Provision for the use of personal décor items in patients' rooms, with 6.8%, and Separate male/female waiting rooms with 4.2%

On the first instruments related comments on the first of these two criteria included the need for 'Regulations about visitors bringing in food from external sources' which had a 79% affirmation and for 'Regulations about patient bring in decorative accessories for room' which had a 71% affirmation, suggesting a need for control over what food and decorative items patients should be allowed to bring.

One interesting outcome is the low priority ranking given to separate male and female waiting rooms in the second survey, an element required in private healthcare facilities under Article 3.10 of the Saudi Arabian Law of Private Health Institutions (2017). This could be due to changing cultural values in Saudi Arabia.

6.5.1 Spiritual Factors

It is difficult to separate spiritual factors from cultural factors with the Saudi context due to the fact that the predominant Islamic religion dominates most aspects of life including

architectural design, in which, as noted by Eban – Saleh (1996). the built environment is shaped to meet the requirements of the culture .

On the first instrument, Spiritual factors were perceived as slightly more important in adding value with a ranking of 11th of the 14 factors. However, 100% of the participants agreed on the value of having the direction of the qibla (the direction Muslims face for the five daily prayers) clearly marked in patient rooms for the patient and visitors. This was seen as beneficial to staff, in terms of saving time and effort and for patients and visitors in terms of ease of identifying direction for prayer.

In their 2018 study, Cruz, et al. found that an environment which is conducive to spirituality improves patient, nurse and organizational outcomes; they also noted a need to 'improve the spiritual climate' in Saudi hospitals.

6.6 Aesthetics/comfort and well-being

The aesthetic appeal of a healthcare facility has a positive association with employee satisfaction and good work relationships (Varni, et al., 2004; Zimring & Ulrich, 2004; Mroczek et al.2005) and positive medical outcomes (Zengul & O'Connor, 2013) and is therefore related to comfort and well-being.

The highest priority ranking under Aesthetics/comfort and well-being was given to Single Patient Rooms with 34.2%. This was followed by Lighting and Air quality with 25.0%. The sub-factor Accommodations for Visitors was in third place with 23.9%. Spiritual and Quiet Places ranked fourth with 7.9%. The two sub-factors with the lowest rating were Natural Views with 6.7% and Art Displayed with 2.3%.

Comments related to the value of aesthetic appeal and indoor climate, lighting and air quality on the first instrument all acknowledged understanding of how these factors affect user well-being and patient outcomes. These included: *'Related to better patient outcomes', 'Pleasing to the eye and mind', 'This is important to staff and patient and patient family'* and *'Comforting and healthy for workers and patients'.* This concurs with Ahmad, Singh, Kamal, and Shaikh (2020) who suggest the provision of aesthetically appealing lighting conducive to a healing environment.

Sufficient available seating for guests' was given 86% affirmation; however, some of the comments suggested a negative attitude toward a large number of guests (the Saudi norm) in the patients' room.

6.7 Costs

Porter, (2016); Ho, et al (2017) and Cipriano, (2017) argue that reduction of costs should not be a primary focus suggesting that a focus on positive medical outcomes (which have been found to be both directly and indirectly related to building design), would be a more accurate measurement. The results from both the first and second instruments reflect agreement that cost should not be of primary importance when considering how value is added to a healthcare facility. In the second instrument, cost, which included both initial building costs, maintenance costs, and medical costs, had the lowest priority of the 6

factors. Economic factors also had a lower rating on the first survey, ranking 12th of the 14th factors in perception of added value.

6.8 Chapter Summary

In this chapter the results of the two surveys, the expert survey and the AHP survey instruments have been synthesized in order to develop a proposed framework for healthcare facility design in Saudi healthcare facilities.

In the following chapter, the proposed framework is presented and discussed.

CHAPTER VII

A FRAMEWORK FOR THE DESIGN OF HEALTHCARE BUILDINGS IN SAUDI ARABIA

Introduction to Chapter 7

In this chapter a framework developed based on the synthesized results of the two instruments is proposed for adding value to healthcare facility design in Saudi Arabia.

The combined results of the two instruments resulted in a framework for multi-user priority based design decision making for healthcare facilities in Saudi Arabia.

7.1 The Framework

This thesis has gone through multiple mixed method data collection to develop a framework for the design of healthcare facilities in Saudi Arabia. After analysing the data collected from the literature review, the expert survey and the AHP survey and synthesizing the results, the framework was developed based on the findings.

7.2 Discussion

The framework for design that adds value to a healthcare building in Saudi Arabia is based on the combined findings of data generated by the first instrument upon which the development of the second was based, and the priority rankings of the resulting six main criteria and the sub-factors generated by the second instrument.

The data collected from the literature review generated a list of factors which were then used to form the expert survey. The expert survey validated the factors and generated additional qualitative data which was analysed using Nvivo thematic analysis. This resulted in several emerging themes both directly and indirectly related to healthcare facility design. Some of the factors which are indirectly related to building design are staff and patient well-being and satisfaction, medical outcomes, and staff care and attitude, all of which can be affected by various design features. The factors directly related to design were then extracted and used the form the AHP survey instrument and gain the weighted priority of the validated factors.

The framework is based on the following table which shows the relationship among main criteria, sub-factors and indirectly related factors which add value to healthcare facilities.

	Criteria to be considered in order of perceived priority in adding value	Specific Design Factors in order of Added Value	Value Adding Factors that are Indirectly Related
1.	**Risk and Safety**	A. Design adheres to all medical risk and safety regulations B. Design adheres to all fire safety regulations	• Medical Outcomes • Staff and Patient Satisfaction
2.	**Accessibility and Way-finding**	C. Well planned internal traffic flow to facilitate mobility of all users including ease of elevator access D. Clear and Sufficient Way-Finding/Signage in both Arabic and English so that way-finding is facilitated E. Conveniently located, marked, and easily Identifiable main and Emergency entrances F. Sufficient, Convenient Parking for staff and patients with separate staff parking	• Ease of mobility • Staff and Patient Satisfaction • Saved effort for all Users
3.	**Functionality**	G. Locating Operating Theatres so that they are quickly and easily accessible from other	• Ease and speed of Mobility • Staff and Patient Satisfaction • Staff Performance

		departments and through routes which support patient privacy during transport H. Locating the emergency room so that transport to other areas such as ER and other departments is facilitated I. Having a centralized department layout which facilitates departmental interaction but also supports fast and easy formation of multi-disciplinary teams as needed J. Organizing design layout to facilitate workflow through internal traffic flow and location of frequently interacting departments. K. Ease of access to and distribution of Supplies/Equipment for all staff through location of distributions points and traffic flow	• Medical Outcomes • Ease and Speed of Formation of Multi-disciplinary teams
4.	**Cultural factors**	L. Having accommodations and facilities in the patient's room for a 24/7 caretaker/family member M. Having the layout of the room give a clear path to facing the Muslim prayer direction including placing the patient bed in such a way as that the patient is facing this direction and clearly visible signage which shows the direction for prayer (Qibla) N. Regulations that allow personal décor items to be brought to patients' rooms (bedding, small tables, etc.) O. Separate Male/Female waiting rooms	• Patient and Visitor Satisfaction • Staff Satisfaction and Performance • Staff Care and Attitude • Aesthetic appeal leading to increased levels of satisfaction
5.	**Aesthetics, comfort and Well-being**	P. Single Patient Rooms Q. Sufficient high quality lighting and air R. Sufficient accommodations for several visitors at a time S. The provision of quiet/spiritual spaces (gardens, meditation, religious spaces) T. Natural Views U. Walls on with art is displayed	• Privacy (highly valued cultural factor) • Staff Patient and visitor Well-being • Increased Positive Medical Outcomes • Increased aesthetic appeal leading to increased levels of satisfaction • Improved Staff Attitude • Improved mental and emotional Health
6.	**Cost**	V. Cost of medical care directly related to the design of the healthcare facility	• Increased cost for Medical Treatment due to investment in Building Design

		W. Initial building costs X. Maintenance Costs	• Ability to maintain, and adapt facility

Table 67 Proposed Framework for Adding Value to Saudi Healthcare Facilities through Design

The main criteria and sub-factors are presented below in order of the priority determined by their pairwise comparison through the AHP second survey instrument. In addition, the factors adding value which are indirectly affected by these main criteria and sub-factors are presented.

7.2.1 Risk and Safety

The main criteria of 'Risk and Safety' encompass the sub-factors of adherence to all medical risk and safety and fire safety standards. These factors can indirectly affect the factors of 'Medical Outcomes' and 'Staff and Patient Satisfaction'.

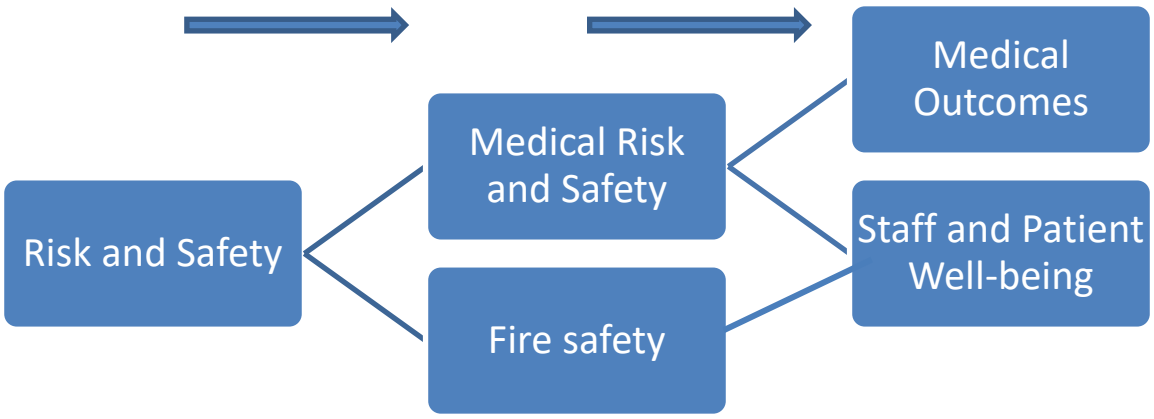


Figure 37 Risk and Safety Factor Relationship

The risk and safety factor has two main sub-factor: Medical risk and safety, which in turn can impact medical outcomes and staff and patient well-being; and fire safety, which can impact staff and patient well-being.

7.2.2 Accessibility and Way-finding

The main criteria of Accessibility and Way-finding encompasses the sub-factors of 'Well planned internal traffic flow ', Clear and Sufficient Way-Finding/Signage in both Arabic and English' , Conveniently located, marked, and easily Identifiable main and Emergency entrances' and 'Sufficient, Convenient Parking for staff and patients with separate staff parking'. The value adding factors that are indirectly affected by these design factors are 'Ease of mobility', enhanced ' Staff and Patient Satisfaction' and 'Saved Time and Effort' for all users.

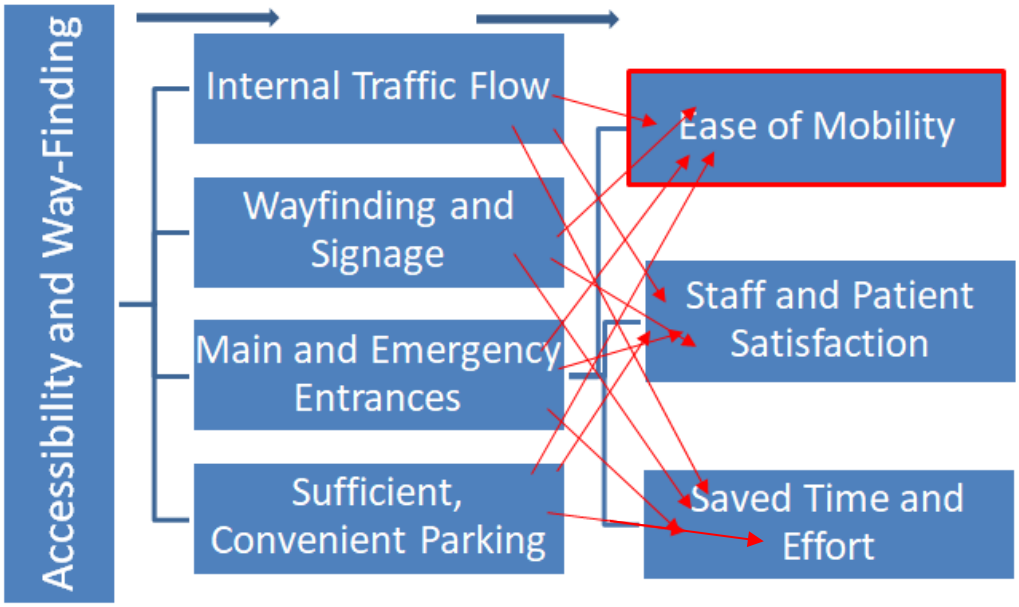


Figure 38 Accessibility and Way-finding factor Relationship

Based on the findings, value added by Accessibility and Way-finding is related to the sub-factors of internal traffic flow, way finding and signage, the ease of access to main and emergency entrances and sufficient and convenient parking. These in turn affect ease of mobility and transport into and throughout the facility, level of staff and patient satisfaction and result in saved time and effort for users.

7.2.3 Functionality

The main criteria of Functionality encompasses the sub-factors of locating operating theatres so that they are quickly and easily accessible from other departments and through routes which support patient privacy during transport, locating the emergency room so that transport to other areas such as ER and other departments is facilitated, having a centralized department layout which facilitates departmental interaction but also supports fast and easy formation of multi-disciplinary teams as needed, organizing design

layout to facilitate workflow through internal traffic flow and location of frequently interacting departments and ease of access to and distribution of supplies and equipment for all staff through location of distributions points and traffic flow. The factors indirectly affected by these are time and effort of all users, staff and patient level of satisfaction, staff performance, medical outcomes , and the ease and speed of the formation of multi-disciplinary teams

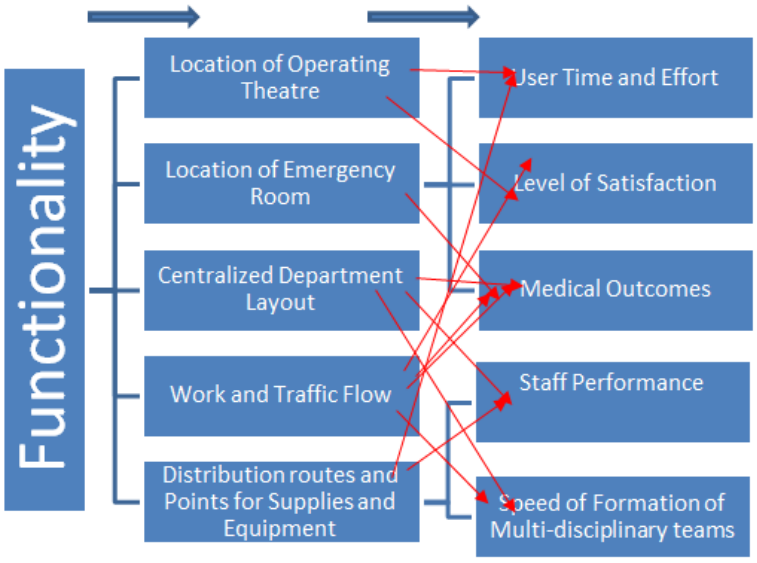


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Figure 39 Functionality Factor Relationship

7.2.4 Cultural factors

The main criteria of Cultural Factors encompasses the sub–factors of space within the room for the accommodation of a caretaker; a layout giving a clear path for patient (including a bed-ridden patient) and visitors to face the direction for Islamic prayers and signage that clearly shows what this direction is; regulations (and space) that allow

patients to bring in personal décor items such as small tables, personal bedding, decorative plates and cups to serve visitors; separate male and female waiting rooms. The value adding factors indirectly affected by these design features are patient and visitor satisfaction, staff satisfaction and performance, which in turn affects staff care and attitude. Other factors are the overall aesthetic appeal which can affect level of satisfaction and emotional and mental well-being. The next to last sub-factor of the value added by the room (and policy) which allows for personal décor items , can contradict with Risk and Safety factors as they may create a fire or other safety risk.

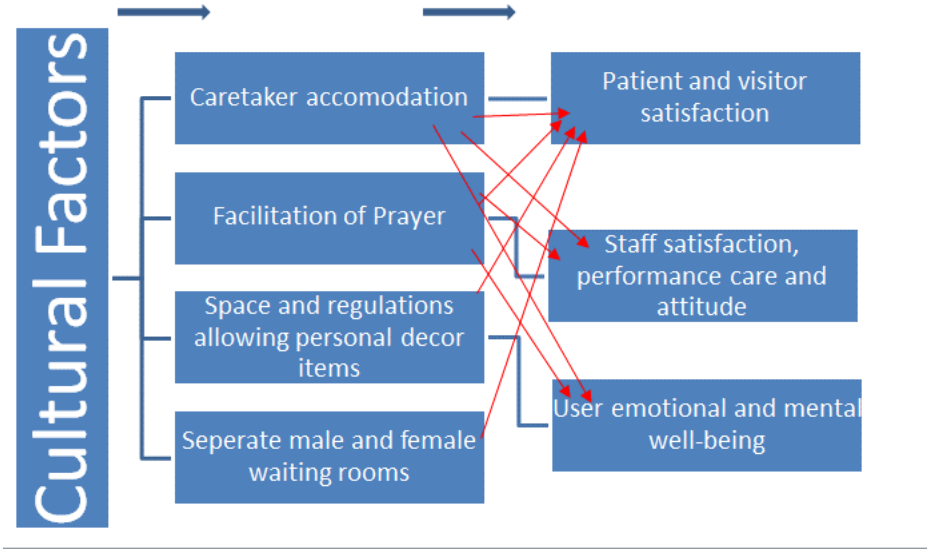

Figure 40 Cultural Factors Relationship

7.2.5 Aesthetics, comfort and Well-being

Under the main criteria of Aesthetics Comfort and Well-being the sub-factors were single patient rooms, high quality lighting and air, sufficient accommodations for several visitors

at a time, provision of quiet/spiritual spaces (gardens, meditation, religious spaces), natural views and displayed art. Factors that add value to a healthcare facility indirectly related are privacy, which is a highly valued cultural factor; staff patient and visitor well-being ; medical outcomes, and aesthetic appeal and level of satisfaction, staff attitude.

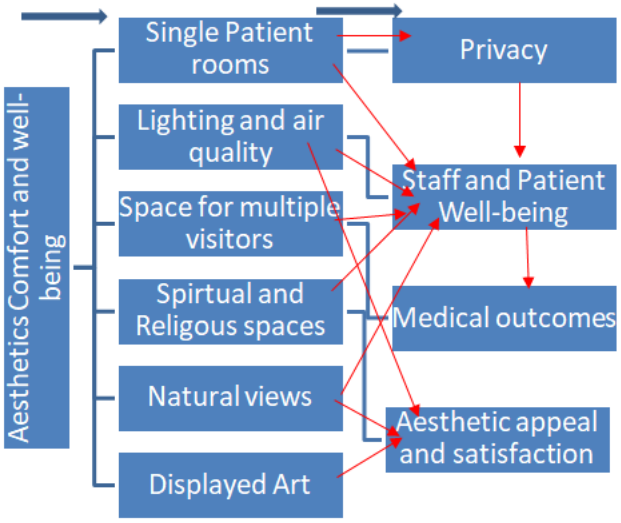

Figure 41Aesthetics Comfort and Well-Being Factor Relationship

7.2.6 Cost

Under the main criteria of Cost, are the sub-factors of cost of medical care directly related to the design of the healthcare facility, the initial building costs, and the cost of maintaining the building. These factors can affect the cost for Medical Treatment and the ability to maintain, and adapt the facility as the need arises.

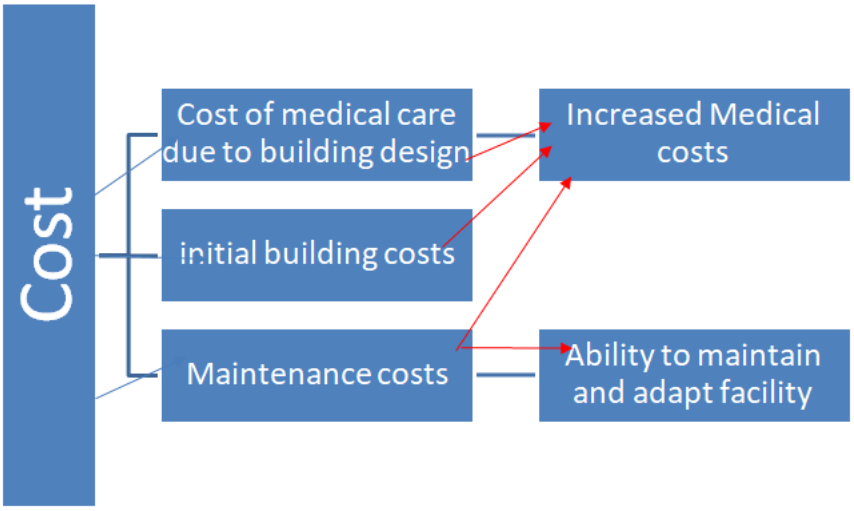

Figure 42 Cost Factor Relationship

The value of the framework is based on the E-O-H proposed by Zhang, Tzortzopoulos & Kagioglou (2018), which proposes that no single characteristic in healthcare building design will achieve the full potential of added benefits and that the application of positive design characteristics result in a cumulative beneficial effect. Thus it is necessary to not only determine the specific factors that are perceived as adding value to a healthcare facility, but also to gain insight into the priority given to those factors by multi-user groups. This includes specific factors specific to the culture of Saudi Arabia as studies have shown that culture has an impact on the user perceptions of the value of design factors in healthcare facilities (Bromley, 2012; Health Building Note 00-01).

Proposed Framework to Add Value to Healthcare Facility Design

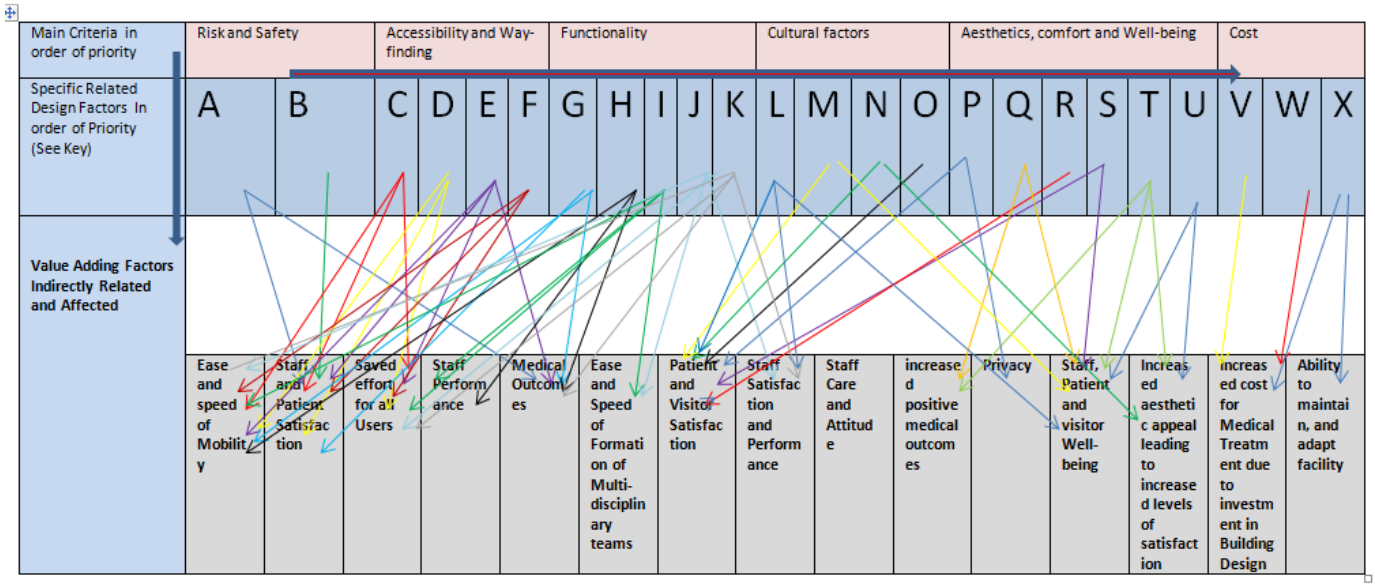

Figure 43: Framework for Added Value

Key for Specific Design Factors

Specific Design Factors in order of Added Value
A. Design adheres to all medical risk and safety regulations B. Design adheres to all fire safety regulations
C. Well planned internal traffic flow to facilitate mobility of all users including ease of elevator access D. Clear and Sufficient Way-Finding/Signage in both Arabic and English so that way-finding is facilitated E. Conveniently located, marked, and easily Identifiable main and Emergency entrances F. Sufficient, Convenient Parking for staff and patients with separate staff parking
G. Locating Operating Theatres so that they are quickly and easily accessible from other departments and through routes which support patient privacy during transport

H.	Locating the emergency room so that transport to other areas such as ER and other departments is facilitated
I.	Having a centralized department layout which facilitates departmental interaction but also supports fast and easy formation of multi-disciplinary teams as needed
J.	Organizing design layout to facilitate workflow through internal traffic flow and location of frequently interacting departments.
K.	Ease of access to and distribution of Supplies/Equipment for all staff through location of distributions points and traffic flow
L.	Having accommodations and facilities in the patient's room for a 24/7 caretaker/family member
M.	Having the layout of the room give a clear path to facing the Muslim prayer direction including placing the patient bed in such a way as that the patient is facing this direction and clearly visible signage which shows the direction for prayer (Qibla)
N.	Regulations that allow personal décor items to be brought to patients' rooms (bedding, small tables, etc.)
O.	Separate Male/Female waiting rooms
P.	Single Patient Rooms
Q.	Sufficient high quality lighting and air
R.	Sufficient accommodations for several visitors at a time
S.	The provision of quiet/spiritual spaces (gardens, meditation, religious spaces)
T.	Natural Views
U.	Walls on with art is displayed
V.	Cost of medical care directly related to the design of the healthcare facility
W.	Initial building costs
X.	Maintenance Costs

Table 68 Key for Specific Design Factors on Framework

The proposed framework can be applied in the design stage for both not yet constructed healthcare facilities and previously constructed facilities that are undergoing renovation to make design and layout decisions that add value to the facility. There is a strong relationship between risk and safety and all the other factors, as risk and safety must be considered in all aspects of the healthcare facility design. Other factors such as aesthetics, comfort and well-being are interrelated with the aspects of the cultural factors which provide comfort and promote well-being such as a room layout which facilitates prayer in the required direction, and patient room size which accommodates a caretaker and multiple visitors at one time. Accessibility and way-finding are related to functionality in that ease of access and movement can improve functionality. Finally, cost is also interrelated with all of the other factors, as the application of each design factor and sub-factor will result in incurred costs.

7.3 Implementation Guidelines

The following guidelines are given for implementation of the framework:

1. The potential impact of risk and safety on all design factors must be consider during the design phase.
2. The hospital location must accommodate sufficient parking for staff and other users in close proximity to the building and entrances.
3. The hospital external layout should provide clear and easily accessible paths to clearly identifiable main, emergency and other entrance points.
4. The internal layout should provide clear and well-marked access to main areas.

5. Location of operating rooms, emergency room, and clinics should planned with ease of movement between areas with connected functions and facilitate the formation of multi-disciplinary teams.
6. Distribution of medicines and equipment should be facilitated by a layout that provide clear and fast access.
7. Patient rooms should be single bed and large enough to accommodate a caretaker and multiple visitors at one time.
8. Patient rooms should be laid out to facilitate Muslim prayer direction for patient, caretaker and visitors.
9. Air and lighting should be of high quality throughout the facility and controllable within the patient room.
10. Aesthetic factors such as art and natural views should be considered.
11. On-site mosques or prayer areas should be provided.
12. Other quiet places, such as outside garden areas should be provided.
13. The well-being and comfort of staff, patients and other users should be considered in all aspects of the design.
14. Cost should be considered one of a number of value adding factors and not as the main or only value adding factor .

7.4 Chapter Summary

The upcoming chapter presents the major conclusions, summarises the main findings of this research, presents recommendations for future research and outlines the limitations of the research.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

Introduction to Chapter 8

This chapter gives an overview of the research conducted in 8.1. Then, the contributions made are highlighted in 8.2. After that, limitations of this research are pointed out in 8.3. The chapter is concluded with suggested directions for future work in 8.4.

This thesis started with an aim of developing a framework for design features that add value to a healthcare building design in Saudi Arabia. In order to satisfy this aim, following objectives were set.

1. To identify through literature review the key value drivers for healthcare facilities.
2. To validate and gain insight into the factors within the Saudi context through an expert study.
3. To conduct a weighted comparison of the added value of validated factors
4. To develop a framework to aid in healthcare facility building design decisions for Saudi Arabia.
5. To draw conclusions and to identify future areas of research.

The first objective was satisfied through an extensive review of the literature. This review of literature helped establish the factors both directly and indirectly affect the value of a healthcare facility in general. However, there was not a lot of comprehensive literature specific to Saudi Arabia available, leading to the main objective of this research.

The second objective was to validate validate and gain insight into the factors identified in the literature review within the Saudi context through an expert study. This helped develop understanding and insight, and was utilised to develop the MCDM data collection instrument that was to gain the weighted priority of the identified factors.

The third objective , which was to conduct a weighted comparison of the added value of validated factors directly related to design was accomplished through an AHP instrument.

The fourth objective of conceptualising a framework to aid in healthcare facility building design decisions for Saudi Arabia was accomplished based on the combined results of the two instruments.

The final objective of presenting conclusions and recommendations is undertaken in this chapter.

8.1 Conclusions

All the initial objectives of this thesis have been satisfied and the conclusions based on the study are as follows:

1. There are factors both directly and indirectly related to the design of a healthcare facility building which add value to the healthcare facility from a multi-user perspective. A focus on a particular aspect of the design can increase or

decrease user satisfaction and subsequently medical outcomes and staff and patient well-being, staff motivation, and staff attitudes.

2. These factors can be both universal and apply to all healthcare facilities in any culture or geographic location, or they can be specific to a geographic location or culture. The need for larger sized patient rooms to accommodate for a caretaker and for a larger number of visitors and for ease of prayer being made in the direction of the qibla were two of the specific noted factors.
3. Some common design features of Saudi healthcare facilities, such as separate male and female waiting rooms, were not seen as adding much value to the building design. This suggests that changing cultural and social norms require adaptation of some of the design factors considered integral to healthcare facilities in Saudi Arabia.
4. The factors can be categorized into six main areas of design focus: Risk and Safety, Accessibility and Way-finding. Functionality, Cultural Factors, Aesthetics, comfort and Well-being, and Cost each of encompasses a number of specific design features as sub-factors. These factors have additional indirectly related factors that are affected by the building design which have been found to add value to a healthcare facility.
5. These factors can be prioritized in order to make Evidence Based Design designs based on the perceived added value.
6. This study has proposed a framework based on the prioritization of the factors for the use in the design of healthcare facilities within the specific cultural context of Saudi Arabia.

7. Validation of the framework was not undertaken as the factors that were used to develop the criteria for the second survey instrument were validated in the first instrument, and the weighted comparison of the factors in the second instrument were collected from a multi-user perspective and validated by the consistency ratio.

8.2 Contributions

1. It is expected that this study will give valuable insight for designers, architects, engineers and hospital administrators to assist in making design and design layout decisions based on design factors that add value for healthcare facilities in the Kingdom. This could be of particular benefit when organizations from outside of the Kingdom are contracted to design and/or construct the healthcare facilities.
2. The framework can provide a tool for designers and other stakeholders to base healthcare facility design decisions on.
3. The study can also be of value when diverse cultures undertake similar studies as a comparison tool for that study.

8.3 Research Limitations

1. One major limitation was the small number of participants in both samples.

2. A second was the limitations on face-to-face interaction to conduct the instruments brought about by COVID 19, which resulted in the need to use Zoom and other online video and audio software to give support to participants.
3. A third and major limitation is that the study was conducted on a sample drawn from three major cities in Saudi Arabia, (Riyadh, Jeddah, and Dammam) and due to the diverse sub-cultures in other often less multi-cultural and more conservative areas around the Kingdom, the results may not reflect universally accepted views.

8.4 Recommendations for Future Work

1. Further studies in which specific designs are evaluated in the Saudi context would serve to reduce current gaps in the literature.
2. In addition, studies conducted on larger and more diverse samples would be of value to get a wider multi-user perspective.
3. It would also be of value to determine which design features are universally seen to add value and which are culturally specific to diverse cultures.
4. The same instruments could be utilized to conduct studies in different urban and rural settings in Saudi Arabia to either validate the findings of this study, or determine the existence of diverse sub-cultural perspectives.
5. Another direction of future work could be to conduct the same AHP instrument on several diverse homogeneous groups and compare the results.

6. It would be of value to validate the framework through an expert review both in the geographical areas of this study, and in diverse areas both within and out the Kingdom to compare and contrast findings.
7. The framework could be tested by applying it to an as yet not built healthcare facility design and once the facility has been built collecting data on the level of user satisfaction with the design.

8.5 Chapter Summary

Conclusions and recommendations for future work are outlined in this chapter, along with the contributions and limitations of the study.

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10. APPENDIX A ETHICAL APPROVAL

UNIVERSITY OF WOLVERHAMPTON

21 July 2020

Dear Bedour Fadel

RE: Managing the Value Chain for Cancer healthcare Facilities/Buildings in Saudi Arabia

Thank you for submitting your ethics application form to the FSE Ethics Committee for review.

I am pleased to inform you that your project 'Managing the Value Chain for Cancer healthcare Facilities/Buildings in Saudi Arabia' was discussed by the Committee and approval was granted by Chair's Action 17th July 2020, following receipt of requested amendments: REC number **LSEC/201920/MA/148.**

The Committee wishes you every success in your research project.

Kind regards,

[redacted]

Professor Tracy Warr
Professor of Neuro-oncology and Director of Research Institute of Healthcare Sciences
Chair of FSE Ethics Committee
Faculty of Science and Engineering
University of Wolverhampton

Dean: Professor Amar Aggoun Ingenieur d'etat (Electronic), PhD, MBCS
University of Wolverhampton, Faculty of Science and Engineering, Alan Turing Building,
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THE UNIVERSITY OF OPPORTUNITY

APPENDIX B: COPY OF COVER LETTER

Dear Sir/Madam,

Determining the design elements that add value to healthcare facilities from a multi-stakeholder perspective can provide beneficial knowledge to the building designer and result in a healthcare building/facility with added value.

This survey is part of a PhD research project at the University of Wolverhampton.

You are invited to participate in this study because you are a professional employee at a healthcare facility in Saudi Arabia, have been a patient or visitor at a healthcare facility in Saudi Arabia, or are an individual with building design experience in Saudi Arabia.

The aim of this research is to investigate the value drivers for the building design of healthcare facilities/buildings in Saudi Arabia in order to provide insight into the design factors that add the most value.

The specific objectives are:

1. Identify design factors that add value to the healthcare building from a multi-stakeholder perspective.
2. Compare the identified design elements to determine comparison weights and identify the factors that add the most value.
3. Propose a framework for adding value to the design of healthcare building in Saudi Arabia.
4. Discuss overall findings and outline future research recommendations.

Participation in this questionnaire is voluntary and confidential. Participants have the freedom to withdraw at any time during the survey process before electronic submission of the questionnaire. Neither participant information nor feedback will be shared with any person or agency. All participants' responses will be eventually consolidated and used in this research. If you decide to receive a summary of the research outcomes, please provide us with your contact details at the end of the questionnaire and will share the research findings with you. All submitted responses will be password protected and saved electronically under the researcher's responsibility. Furthermore, questionnaire responses will be destroyed within two years of receipt.

Please complete the questionnaire and return it to me by [INSERT DATE] via email [e-mail address redacted].Should you need any further clarifications or assistance in this matter, please do not hesitate to contact me.

Thank you and I look forward to receiving your feedback soon.

Sincerely yours,

Bedour Fadel
Email: [e-mail address redacted]
Tel: [number redacted]

APPENDIX C: Participant Information Sheet for Stage 2

Participant Information Sheet

Study Title: Managing the Value Chain for Cancer Healthcare Facilities/Buildings in Saudi Arabia

Researcher: Bedour Fadel

Ethics number: LSCE/ 201920/MA/148

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

This research is required as part of the researcher's PhD degree in Built Environment. The aim of this research is to investigate the value drivers for the value chain at healthcare facilities/buildings in Saudi Arabia in order to provide insight into managing the value chain.

For the implementation of this research, you will be asked to note whether or not a particular item related to a value driver adds value to the value chain. Your opinion and expert knowledge will help in identifying the factors and items that add value to the value chain.

Why have I been chosen to participate?

You are invited to participate in this study because you are a professional employee at a healthcare facility in Saudi Arabia with 5 or more years working experience.

What will happen to me if I take part?

I will ask you to sign a consent form, and then the study will begin. You will be given a survey to complete.

Are there any benefits in my taking part?

This research is not designed to help you personally, but your feedback will help me gather expert opinions on value drivers of the healthcare facility value chain.

Will my participation be confidential?

Yes. Your data and that of other participants will be stored and used on secure systems. Any stored data will not be linked to your name. Any information related to your organization will not be disclosed, the type of organization will be mentioned only.

Are there any risks involved?

No.

What happens if I change my mind?

You have the right to terminate your participation in the research at any stage of the survey process before submission; however, once the questionnaire has been submitted, you cannot request removal of the data you have provided on the questionnaire from the study.

Where I can get more information?

For further details, please contact either myself or my study supervisor,

Bedour Fadel: [e-mail address redacted] [telephone number redacted]

Supervisor: Professor Mohammed Arif: [e-mail address redacted]
[telephone numbers redacted]

APPENDIX D: Instrument for Expert Sample

My name is Bedour Fadel; I am a PhD researcher at the University of Wolverhampton**.** My research focuses on Managing the Value Chain for Cancer Healthcare Facilities/Buildings in Saudi Arabia . As part of my study I am conducting expert interviews to measure the value drivers. The value drivers will be determined based on your responses and then be weighted through a second survey instrument.

Your input will be very valuable to this study. By taking part in this study, you are agreeing to my use of your responses in my research. This questionnaire is anonymous and no personal data will be collected. Thank you for your time in completing this questionnaire.

To participate in this study, please read the supplemented questionnaire and then answer the following questions about it.

For further details, please contact either myself or my study supervisors,

Bedour Fadel:

Part 1:

1) Have you worked at a hospital in Saudi Arabia in a professional capacity?
    - Yes
    - No
2) Choose the option that best reflects your years of experience
    - Less than 2 years
    - 2 – 5 years
    - 6 – 10 years
    - More than 10 years

1) Part 1: This part of the interview seeks to break the value driver down into specific related factors. In the table below , factors that could add value to the value chain are proposed. Please state whether you find the proposed factor important or not.

Value Driver	No	Selected Items	Check items that add value	Reason for Response
Location/ Accessibility	1	Close to major roads and thoroughfares		
	2	Ease of access through traffic flow		
	3	Sufficient parking		
	4	Proximity of available parking to building		
	5	Well marked signs signifying location		
	6	Clear and direct access to entry points		
	7	Location of units with a high flow rates such as ER near an entrance to avoid unnecessary internal traffic flows		

	Clear and close access to elevators from entrance
Are these items adequate to represent *location and accessibility*?	
Can you suggest additional items to represent *location and accessibility*?	
Building Design	Flow-through internal traffic design
	Age of building
	Aesthetic appeal of building design
	High quality indoor climate, lighting and indoor air quality.
	Ease of access and navigation to all areas of the building for the self-mobile and those who need mobility assistance.
	Adaptable to allow for changes in layout, function and patient volume
	Optimally facilitating medical care processes and supporting activities by spatial layout of top-clinical care areas.
	Well considered location of operation theatres.
Medical Facilities	Availability of medicines/treatment.
	Availability of modern medical equipment
	Well-equipped clinics
	24/7 Emergency services
Are these items adequate to	

represent *medical factors*?	
Can you suggest additional items to represent *medical factors*?	
Professional	Qualified professional medical staff
	Variety of specialists/consultants
	Multi-disciplinary teams easily formed as needed
Are these items adequate to represent *professional factors*?	
Can you suggest additional items to represent *Professional factors*?	
Technical	Consistent connectivity to allow for information flow.
	Clear process for and accuracy of internal information transfer.
	Easy and place and time independent access to (digital) data.
	Availability of digital appointment services.
Are these items adequate to represent *technical factors*?	
Can you suggest additional items to represent *technical factors*?	

Operational	Clearly established operational plan for logistics and supplies
	Well planned logistics for smooth transport of beds, bedclothes, food, medical facilities separate to patient traffic flows.
	Well-considered distribution points.
	Well developed and efficient inventory and ordering system.
Are these items adequate to represent *operational factors*?	
Can you suggest additional items to represent *operational factors*?	
Procedural	Ease and speed of appointment process.
	Time to get an appointment.
	Time and procedure for patient admission.
	Protection of patient's right to privacy with respect to information sharing.
Are these items adequate to represent *procedural factors*?	
Can you suggest additional items to represent *procedural factors*?	
Economic	Resources available to maintain consistent flow of quality supplies and equipment

	Resources available to ensure staffing needs are met.
	Care/treatment cost.
	Partnership with medical insurance carriers.
Are these items adequate to economic factors?	
Can you suggest additional items to represent *economic factors*?	
Policy	Sufficient clinic opening hours and operating time.
	Caretaker allowed to remain with patient 24/7
	Regulations about patient bringing in decorative accessories for room.
	Regulations about visitors bringing in food from external sources.
Are these items adequate to represent *policy*?	
Can you suggest additional items to represent *policy?*	
Facilities / Patients Rooms	Size of room
	Appearance of room
	Sleeping facilities within patient's room for caretaker/companion.
	Availability of 'suites'.
	Sufficient available seating for guests.
Are these items adequate to represent *factors*	

related to patient rooms?	
Can you suggest additional items to represent *factors related to patient rooms*?	
Staff care and Attitude	Staff shows care and concern
	Staff consistently adheres to professional standards when interacting with patient.
	Staff can communicate in Arabic
	Staff is consistently polite and respectful.
	Staff responds to requests in a timely manner.
Are these items adequate to represent *staff care and attitude*?	
Can you suggest additional items to represent *staff care and attitude*?	
Culture	Staff can speak Arabic
	Female/male staff assigned based on patient gender
	Staff is culturally sensitive (eg. Covering female patients completely during transport)
Are these items adequate to represent *cultural factors*?	
Can you suggest additional items to represent *cultural factors*?	

Spiritual	Mosque or prayer room onsite.
	Qibla (direction of Kaaba in Mecca) clearly marked.
	Internal and external ‘sanctuary’ spaces
Are these items adequate to represent *spiritual factors*?	
Can you suggest additional items to represent *spiritual factors*?	
Risk and Safety Standards	Well-developed safety standards
	Fire/containment doors
	Emergency equipment readily available and accessible and regularly maintained.
	Emergency routes/exits clearly established and marked.
	Clear and visible procedures for emergency situations established
	Hazardous materials appropriately handled within an established system
	Clear and consistently checked patient identification
	Clear and consistent patient visibility
	Patient handover is minimized and consists of a comprehensive review of patient’s condition and care needs at handover.
Are these items adequate to represent Risk and Safety Standards?	.
Can you suggest additional items to	

represent Risk and
Safety Standards?

Part2: Please rate the importance of the following value drivers in consideration of the factors noted above, on a scale of 1-5.

Factors	Rating Scale				
This value driver is:	Not important	Slightly important	Moderately Important	Important	Very Important
	1.	2.	3.	4.	5.
1. Location/Accessibility	○	○	○	○	○
2. Building Design	○	○	○	○	○
3. Medical	○	○	○	○	○
4. Professional	○	○	○	○	○
5. Technical	○	○	○	○	○
6. Operational	○	○	○	○	○
7. Procedural	○	○	○	○	○
8. Economic	○	○	○	○	○
9. Policy	○	○	○	○	○
10. Patient's Room	○	○	○	○	○
11. Staff care and Attitude	○	○	○	○	○
12. Culture	○	○	○	○	○
13. Spiritual	○	○	○	○	○
14. Risk and Safety	○	○	○	○	○

Part 3: Please answer the following questions about the instrument in general.

No	Question	Agree	Disagree	Comment
1	The wording of the instrument is appropriate.			
2	The responses of the instrument are appropriate.			
3	The layout of the instrument is appropriate.			
4	The length of the instrument is appropriate.			
5	The instrument is easy to read and understand.			

APPENDIX E: Participant Information Sheet for Stage 3

Participant Information Sheet

Study Title: Managing the Value Chain for Cancer Healthcare Facilities/Buildings in Saudi Arabia

Researcher: Bedour Fadel

Ethics number: LSCE/ 201920/MA/148

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

This research is required as part of the researcher's PhD degree in Built Environment. The aim of this research is to investigate the value drivers for the value chain at healthcare facilities/buildings in Saudi Arabia in order to provide insight into managing the value chain.

For the implementation of this research, you will be asked to compare factors related to the design of a healthcare building and rate them based on how they compare in terms of importance. Your opinion and expert knowledge will help in identifying the factors and items that add value to the value chain.

Why have I been chosen to participate?

You are invited to participate in this study because you are a professional employee at a healthcare facility in Saudi Arabia, have been a patient or visitor at a healthcare facility in Saudi Arabia, or are an individual with building design experience in Saudi Arabia.

What will happen to me if I take part?

I will ask you to sign a consent form, which will be sent to you electronically; once you have given your consent for voluntary participation the study will begin, andyou will be sent a survey to complete and submit.

Are there any benefits in my taking part?

This research is not designed to help you personally, but your feedback will help me gather expert opinions on value drivers of the healthcare facility value chain.

Will my participation be confidential?

Yes. Your data and that of other participants will be stored and used on secure systems. Any stored data will not be linked to your name. Any information related to your organization will not be disclosed, the type of organization will be mentioned only.

Are there any risks involved?

No.

What happens if I change my mind?

You have the right to terminate your participation in the research at any stage of the survey process before submission; however, once the questionnaire has been submitted, you cannot request removal of the data you have provided on the questionnaire from the study.

Where I can get more information?

For further details, please contact either myself or my study supervisor,

Bedour Fadel: [e-mail address redacted] [telephone number redacted]

Supervisor: Professor Mohammed Arif: [e-mail address redacted]
[telephone numbers redacted]

APPENDIX F: AHP Instrument

My name is Bedour Fadel; I am a PhD researcher at the University of Wolverhampton. My research focuses on 'Managing the Value Chain for Cancer Healthcare Facilities/Buildings in Saudi Arabia.' As part of my study I am building an instrument to compare the weighted value of the criteria that have been determined as value drivers in building design..

Your input will be very valuable to this study. By taking part in this study, you are agreeing to my use of your responses in my research. This questionnaire is anonymous and no personal data will be collected. Thank you for your time in completing this questionnaire.

To participate in this study, please read the supplemented questionnaire and then answer the following questions about it.

For further details, please contact either myself or my study supervisor,

Bedour Fadel: [telephone number redacted]

Professor Mohammed Arif: [telephone number redacted]

Please answer the following questions which will be used for demographic data.

Please signify your age range.

- **Under 18**
- **18-24**
- **25-34**
- **35-44**
- **45-54**
- **Above 54**

Please check the box that applies to you in terms of your pre-discussed status.

- **Healthcare Facility Administrator**
- **Architect**
- **Construction Engineer**
- **Patient:**
- **Visitor :**

I would like to elicit your opinion on the compared value added by the alternatives given below in order to determine the factors that add the greatest value to healthcare building design. The pair wise comparison scale shown below is used to express the importance of one element over another (Table 1) with the values as shown. Simply circle the number that best expresses your opinion on the priority of one factor over another.

The scale is shown here for your reference.

Table 1- Saaty Comparison Scale

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order o

A Options																			B Options
		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Main Criteria																			
1.	**Accessibility and Way-finding**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Functionality**
2.	**Accessibility and Way-finding**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Aesthetics/comfort and well-being**
3.	**Accessibility and Way-finding**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Cultural Factors**
4.	**Accessibility and Way-finding**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Cost**
5.	**Accessibility and Way-finding**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Risk and Safety**
6.	**Functionality**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Aesthetics/comfort and well-being**
7.	**Functionality**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Cultural Factors**
8.	**Functionality**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Cost**
9.	**Functionality**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Risk and Safety**
10.	**Aesthetics/comfort and well-being**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Cultural Factors**
11.	**Aesthetics/comfort and well-being**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Cost**
12.	**Aesthetics/comfort and well-being**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Risk and Safety**
13.	**Cultural Factors**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Cost**
14.	**Cultural Factors**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Risk and Safety**
15.	**Risk and Safety**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Cost**
Sub-factors Accessibility and Way-finding																			
16.	**Location and Identification of entrances**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Sufficient, Convenient Parking**

17.	**Location and Identification of entrances**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Well Planned Internal Traffic Flow**
18.	**Location and Identification of entrances**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Clear and Sufficient Way-Finding/Signage**
19.	**Sufficient, Convenient Parking**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Well Planned Internal Traffic Flow**
20.	**Sufficient, Convenient Parking**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Clear and Sufficient Way-Finding/Signage**
21.	**Well Planned internal Traffic Flow**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Clear and Sufficient Way-Finding/Signage**

Sub-factors Functionality

22.	**Centralized Department Layout**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Organization of Work flow**
23.	**Centralized Department Layout**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Access to and distribution of Supplies /equipment**
24.	**Centralized Department Layout**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Proximity of OR to Key Locations**
25.	**Centralized Department Layout**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Location of ER in relation to Clinics**
26.	**Organization of Work flow**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Access to and distribution of Supplies /equipment**
27.	**Organization of Work Flow**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Proximity of OR to Key Locations**
28.	**Organization of Work Flow**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Location of ER in relation to Clinics**
29.	**Access to and distribution of Supplies /equipment**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Proximity of OR to Key Locations**
30.	**Access to and distribution of Supplies /equipment**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Location of ER in relation to Clinics**
31.	**Access to and distribution of Supplies /equipment**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Location of ER in relation to Clinics**

Sub-factors Aesthetics/comfort and well-being

32.	**Single Patient Rooms**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Art Displayed**
33.	**Single Patient Rooms**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Natural Views**
34.	**Single Patient Rooms**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Lighting and Air quality**
35.	**Single Patient Rooms**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Accommodations for Visitors**
36.	**Single Patient Rooms**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Spiritual/Quiet Places**
37.	**Art Displayed**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Natural Views**
38.	**Art Displayed**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Lighting and Air quality**
39.	**Art Displayed**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Accommodations for Visitors**
40.	**Art Displayed**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Spiritual/Quiet Places**
41.	**Natural Views**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Lighting and Air quality**
42.	**Natural Views**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Accommodations for Visitors**
43.	**Natural Views**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Spiritual/Quiet Places**
44.	**Lighting and Air Quality**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Accommodations for Visitors**
45.	**Lighting and Air Quality**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Spiritual/Quiet Places**
46.	**Accommodations for Visitors**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Spiritual/Quiet Places**

Sub-Factors Cultural Factors

47.	**Mosques**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	**Room layout/signage which facilitates prayer (Qibla)**
48.	**Mosques**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Accommodations for caretaker**
49.	**Mosques**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8		**Separate male/female waiting rooms**

50.	**Mosques**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**Provision for Personal Décor Items**
51.	**Room layout/signage which facilitates prayer (Qibla)**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**Accommodations for caretaker**
52.	**Room layout/signage which facilitates prayer (Qibla)**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**Separate male/female waiting rooms**
53.	**Room layout/signage which facilitates prayer (Qibla)**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**Provision for Personal Décor Items**
54.	**Accommodations for caretaker**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**Separate male/female waiting rooms**
55.	**Accommodations for caretaker**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**Provision for Personal Décor Items**
56.	**Separate male/female waiting rooms**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**Provision for Personal Décor Items**

Sub-Factors Cost

57.	**Initial Building costs**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	Maintenance Costs
58.	**Initial Building costs**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	Medical Care Costs
59.	**Maintenance Costs**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	Medical Care Costs

Sub-Factors Risk and Safety

60.	**Design adheres to all risk and safety regulations**	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**Design adheres to all fire safety regulations**